THE

ELECTRICAL REVIEW.

VOL. LXXXIV. MAY 30, 1919. No. 2,166.

ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

ELECTRICITY SUPPLY AND THE I.M.E.A.

THE Incorporated Municipal Electrical Association has lost no time in considering the Electricity (Supply) Bill and in putting forward a series of resolutions and amendments, of which we give particulars elsewhere in this issue. "Subject to such alterations and amendments" as it recommends, the Association considers the Bill acceptable to local authorities.

The tendency of the changes suggested is in the direction of strengthening the powers of the Electricity Commissioners and of the local authorities in certain respects, restricting the rights and privileges of companies, improving the provision for compensation to officials adversely affected, and keeping the supply of electricity out of the hands of the Ministry of Ways and Communications. A new clause is drafted, empowering District Boards and local authorities to pay subscriptions and expenses in connection with Associations and conferences, and thus removing a disability under which municipal undertakings have long suffered; this clause might well be extended to authorise the payment of contributions in support of such beneficial objects as those of the Electrical Development Association. The Association roundly declares that public ownership and control of power stations and main transmission lines are desirable in the national interest. That a measure of public control is indispensable will be generally admitted, but that public ownership would necessarily prove equally satisfactory is open to question; what we have seen of State ownership, before and during the war, is by no means calculated to excite our enthusiasm in favour of its extension to electricity supply. However, it cannot be denied that many of the municipal electrical undertakings have shown excellent results in spite of the restrictions under which they have laboured, and if we may regard the District Electricity Boards as larger editions of the same order, we may hope for good results from them.

We regret, however, that the Association, in defiance of the views of some of its most prominent members, adheres to its determination to exclude, if possible, the companies from the participation in that public control to which, as undertakers authorised by statute, they are justly entitled. Are we to understand that companies (and their shareholders) are not part of the "public"? that they have no rights? and that it is their moral duty, "in the national interest," to commit hara-kiri of something of that sort? If there had been no company undertakings to blaze a track through the forest of obstruction and disappointment in the early days, there certainly never would have been any municipal electrical undertakings or any I.M.E.A. to-day, and we cannot help feeling that the Association takes a narrow view of this subject, unworthy of its past.

We cordially endorse the contention that the provision for compensation to displaced officials is altogether too nebulous and inadequate to serve its purpose; in this connection we may draw attention to the statement of the Electrical Power Engineers' Association, published elsewhere in this issue, that already the shadow of the Bill is falling on its members, and that some of them are likely to suffer injury before it even becomes an Act. The provision for compensation should therefore be made retrospective.

Another notable feature of the I.M.E.A.'s proposals, is that the payment of members of District Boards shall not be adopted. This is a very debatable question, which we cannot now discuss at length; but we may point out that the duties of the Boards will be very onerous—much more so than those of Committee-men—and will make heavy demands on the time of the members, some of whom will have to travel considerable distances to attend the meetings; that the responsibilities will be much more

serious than in the case of most of the existing municipal undertakings; and that it is very important that only good men of business shall take part in the conduct of the Board's affairs. It is but reasonable that some remuneration should be given, and we suggest that it should take the form of a fixed fee per meeting attended—certainly not that of a fixed salary, the effect of which has been demonstrated in the case of the House of Commons. Moreover, the magnitude of the fee should vary from year to year in some way depending upon the success of the undertaking. There is nothing more conducive to careless management or reckless expenditure than the feeling that one's own pocket will not suffer therefrom.

The fact that Sir John Snell, a Past-President of the Association, will be the Chief Electricity Commissioner has been patent to all who are interested in the electrical industry for a long time; it is now public property, and we tender our hearty congratulations to him on his appointment to that distinguished and exceedingly responsible post.

Naval Ratings.

A GOOD deal has been said and written about the re-employment of officers and men who joined the Forces for the period of the war; but nothing has been heard of a class of man who have served the country for a much longer time, but whose occupation is now at an end—namely, the demobilised time-expired and pensioner ratings of the Royal Navy.

In the ordinary course these men, who leave the service after 12 or 21 years, are released in small batches, and are absorbed unnoticed in the labour market; but the war has held them in the Service, and peace is setting them adrift in large numbers. The splendid services that they have rendered are beyond all praise; we all know how they, and the Service to which they belong, were Britain's surest bulwark in her hour of direst need. But what is not so fully realised is that the ex-navy man is a highly-skilled artisan, a valuable asset to the industrial world, a man who can turn his hand to almost anything; these men are electricians, mechanics, firemen, of long experience and proved efficiency. Many of them have risen to non-commissioned rank, and can fill responsible posts, involving the charge of men. They want work comparable to the standard they have attained in the Service, commensurate with their real worth. Employers who are seeking skilled, steady, disciplined men can find them by writing to the Navy Employment Agency, 25, Victoria Street (South Block), S.W. 1.

The I.E.E. Report.

THE annual report of the Institution of Electrical Engineers shows a very satisfactory session's work; the Council and Committees have held no fewer than 191 meetings, a figure which compares well with the highest previous record (159 in 1914), the membership once more exceeds 7,000 (there was a heavy drop during the war, the lowest point being 6,613 in 1917), and the papers read have uniformly attained a high standard of quality. The status of the former "Local Sections" has been greatly improved, many new departures have been made which promise to bear very valuable fruit, and the list of projects which are actually in hand is an imposing one. Even the Benevolent Fund has at last begun to receive attention from the members, and the accounts of the Institution are in a very satisfactory condition. Our congratulations are certainly due to the Council, and especially to the indefatigable President, Mr. C. H. Wordingham, on a record of achievement and promise for the future never before equalled.

We note with interest that the Army Council sent a Commission, on which the Institution was represented, to France to inspect and report upon the electric power supply arrangements in the war areas, which presented a lengthy report; further, that a Committee has been appointed by the Army Council to report upon the future functions and organisation of the Corps of Royal Engineers. We are glad to see that the military authorities are taking steps to increase the technical efficiency of that most honourable Corps, which did such splendid work during the war, in spite of the difficulties under which it laboured.

We commence in this issue a *résumé* of the important address delivered by the President to the Territorial Centres during the session; pressure on time and space compel us to defer comment till a later opportunity, but we recommend our readers to study it *in extenso*, as it is full of interesting matter, and embodies a scheme for the development of the Institution, which is of the utmost importance to all electrical engineers.

The annual meeting was to be held yesterday at the unfortunate hour of 2.30 p.m., which practically disfranchises the great majority of the members, and deprives them of their only opportunity to discuss the affairs of the Institution. Why this mistake, which has given rise to so much bitterness of feeling in the past, has been repeated we are at a loss to divine. It is aggravated on this occasion by a notice, received on the day we go to press, that a meeting to discuss the Electricity Supply Bill will be held at 4 p.m. We cannot think that this procedure is well-advised.

The Control of Electricity Supply in Germany.

THE Verein Deutscher Ingenieure and the Verband Deutscher Elektrotechniker held a joint meeting in Berlin on April 12th, when representatives of the Republican Ministry of Economy, and of other authorities, were also present, to discuss the question of the future regulation of the national electricity supply industry. According to statements placed before the assembly, even the Government has reached no definitely formulated decisions in this direction, although the draft of a national electricity supply Bill may be expected in the near future. A consensus of opinion prevailed that the aim of legislative control should lie in the removal of the great multiplicity of works scattered about the country for the production and distribution of energy, although opposing views were expressed as to the manner in which this object might be achieved. On the one hand, it was contended that compulsory State regulation should take place, and the interconnection of the different works be vested in the hands of the State. The adoption of this course, however, was opposed by Dr. Passavant, representing the Association of Electricity Works, and by Herr Heneke, manager of the Rhenish-Westphalian Electricity Works, of Essen. The latter pointed out that the amalgamation of individual works was not accompanied by economic advantages under all circumstances and in every case, and that State working in particular brought about serious disadvantages. He proposed, therefore, that the electricity supply industry should be transferred to self-administering bodies formed on the basis of voluntary combination, and perhaps endowed by the State with certain public legal privileges; and a union of these bodies in a national committee might be further taken into consideration.

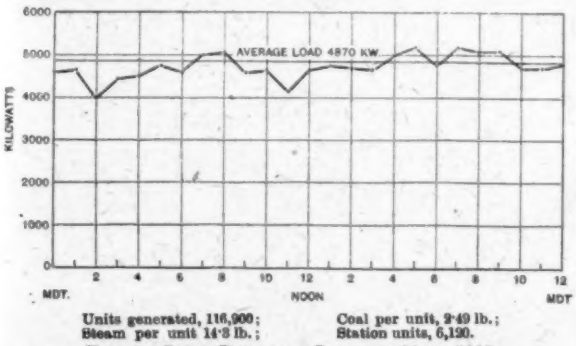
With regard to the financial effects of a reorganisation of the supply industry, the general opinion of those present was that a national electricity monopoly would not yield any considerable revenue to the State, and that special financial results were also not to be expected from a participation by the State in the undertakings entrusted with the supply of electricity in any form whatever. As to the question of electricity supply forming an object of taxation, Herr Raumer, who represented the Electro-Federation, stated that electric power was a competitive article, and the KW.-hour possessed an entirely different economic value according to the special circumstances of consumers. As a consequence, a uniform taxation according to the consumption in KW.-hours should be rejected on account of its widely varying effects. In general, a special electricity tax should also be repudiated because it would stop a really great development in the supply of light and power, and for this reason it was necessary to avoid placing a financial burden on the production and transmission of power. If, however, taxation must come into consideration, it was contended that this should be applied to the sources of power, as in the case of the tax on the production of coal. The conference did not adopt any resolutions on the problem, as the deliberations were solely intended further to clear up opinion on the subject, and thus afford information for the benefit of the Ministry of Economy.

THE ELECTRICAL EQUIPMENT OF H.M. FACTORY, GRETNA.

By A. S. CROSS.

H.M. Factory, Gretna, as all the world knows, was built in 1915-16-17 to supply Great Britain and her Allies with cordite, and is the largest of the many munition factories built by the Government during the war. It is really an aggregate of many factories, the outputs of which combine to provide the requisites for making cordite. Compared with pre-war standards, the ether plant, the sulphuric acid and nitric acid works, the glycerine distillery and the cotton treating plant would each be a very large factory, but all of these were but incidental items in the complete explosives works, and even all these combined cover a very small fraction of the total area of the factory.

Apart from the actual factory buildings were the two townships, one at Gretna, near the centre of the site, and the other at East Riggs, at its eastern end, providing accommodation for about 16,000 people, and including churches, kinemas, clubs and recreation rooms, schools, many shops, post offices, fire stations, central kitchens and bakeries, laundries, and almost everything else required for the welfare of the inhabitants, including police stations and barracks for both men and women police.



Units generated, 116,900; Coal per unit, 2·49 lb.;
Steam per unit 14·3 lb.; Station units, 6,120.

Fig. 2.—Load Diagram, January 29th, 1918.

Practically the whole of the machinery in the factory is electrically driven, and electric lighting is used throughout, so that the electrical installation, as a whole, is probably the most extensive that has ever been carried out as one complete system, although, no doubt, many larger systems exist. Any description of the installation must, in the circumstances, be very brief, but some account of the work may be of interest.

The distribution of the load in the area made the question of the situation of the generating plant one of some difficulty. There is a very heavy load for the pumping plant, which supplies the whole of the factory and townships with water, at Longtown, at the extreme eastern end; the cordite area next to this, going west, has also a fairly heavy load; but apart from the Gretna township, the remainder of the heavy load is all at the extreme eastern end, where is the greatest concentration of buildings, including all the acid plant and the cotton treatment buildings, the last of which provide a very heavy power load. The relative advantages of a single central station and of two separate stations, interconnected, at the two ends of the area were carefully investigated; eventually the single plant was selected, and the site was fixed near the Solway, about a mile south-west of Gretna township. It was intended to connect up the station with the Carlisle supply, but this scheme was eventually abandoned.

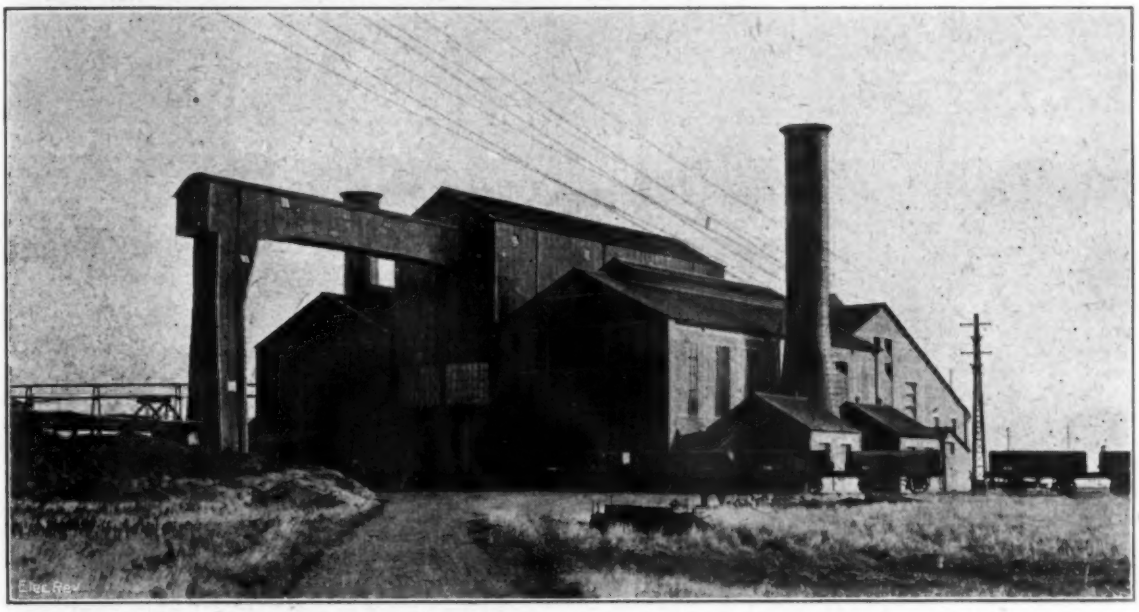


Fig. 1.—Exterior of Power Station, Gretna.

The general arrangement, operating details, and results of running of the power house and H.T. transmission system are given briefly in the following notes:—

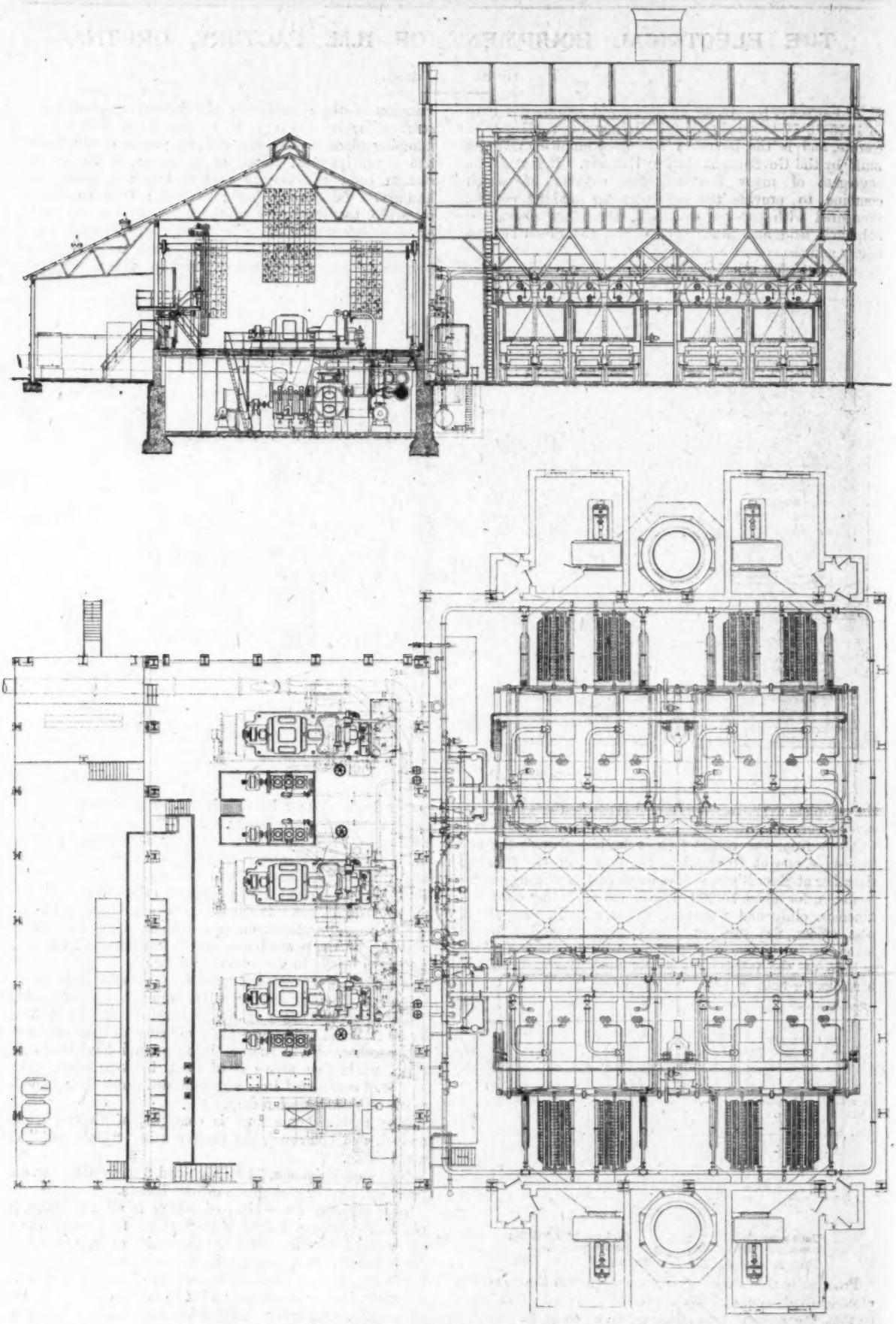
Buildings.—The general lay-out of the station is shown in figs. 3 & 4. It consists of a boiler house measuring 107 ft. 3 in. by 87 ft. 3 in., and a turbine house 95 ft. 6 in. by 50 ft. 6 in., the axes of the two being at right angles to one another. The structure below ground level is of concrete, while that above is of steel, brick-panelled. The roof is of corrugated iron, a matchboard lining being added to obviate condensation drip.

The turbine-house floor is composed of girders, brick-arched, and concreted, the surface being "Doloment" of a red shade.

Two steel chimneys, 72 ft. high and 8 ft. in diameter, are provided, one for each group of four boilers.

Coal Storage, &c.—The coal, which is all rail-borne, is discharged from a height of 16 ft. direct from wagons into an external bunker, which has a capacity of 450 tons, and from thence it is fed by gravity through an automatic filler into the buckets of an electrically-driven Babcock & Wilcox conveyor, having a capacity of 40 tons per hour. At the end of this bunker the conveyor buckets rise vertically, and are then carried over horizontally to be tipped automatically into the inside storage bunkers, which have a capacity of 450 tons, at the point where the coal is required. All the coal passes over a weighbridge shortly before it is dumped into the external coal bunker.

Boiler House.—The boilers are of the Babcock and



FIGS. 3 & 4.—ELEVATION AND PLAN OF POWER STATION AT GRETNA.

Wilcox land type, being arranged in groups of two, four at each side of the boiler house. They are designed for 195 lb. per sq. in., and 550° F. steam temperature, the heating surface of each boiler being 5,346 sq. ft., and of the integral superheater 1,320 sq. ft.

The grates are of the Babcock endless-chain type, the

area of each grate being 70 sq. ft., or 140 sq. ft. per boiler.

The ash is automatically discharged at the rear of the grate into hoppers from which, once every shift, it is fed by gravity into hand trucks, which are electrically tipped into railway wagons, some 12 to 15 tons being normally handled per day. Each boiler has its own 200-tube Green economiser built on to it. The products of combustion enter at a temperature of 470°/530° F., to be reduced to 280°/320° F. on entering the stacks.

Fig. 5.—Part of Main and Auxiliary Switchboards.

The temperature of the boiler feed is raised from 77° F. to 194° F., at which it enters the boilers. The hot-well temperature of 77° F. is raised to 115° F. by a by-pass from the delivery side of the economisers.

Each pair of boilers has its own induced-draught fan, which is capable of maintaining a draught of from 0·5 to 2·3 in. water gauge at the fan inlet. It was usual to work at 1·5 in. at the fan, and 0·7 in. at the boiler, which corresponds to a motor output of 30 H.P., and a fan speed of 332 R.P.M.

The stokers, as well as the economiser scrapers, are electrically driven through counter-shafting suitably arranged.

The boilers are fed by three Weir pumps (one of which is a spare) arranged along the west wall at the end of the firing floor.

Two feed-water storage tanks are provided, one being at each side of the feed pumps. The turbines deliver their condensate through Lea recorders into these tanks, while the make-up is got from the works water supply system. As this water only contains 2° permanent hardness, with temporary hardness nil, no water treatment plant was installed.

Piping.—The steam- and feed-water piping is arranged on the ring system. The supply to the turbines is taken from steam receivers, which form part of the steam ring. The piping systems are sufficiently sectionalised to localise trouble should it occur.

All valves are readily accessible, while each turbine has its own atmospheric exhaust pipe and automatic water-sealed relief valve.

Turbine House.—The turbo-alternators are four in number, three being of 3,000 KW., and one of 1,500 KW. capacity at 0·75 power factor; each set is further capable of carrying a 20 per cent. over-load for two hours.

The turbines are of the B.T.H. mixed Curtis type, designed to run at 3,000 R.P.M. The alternators are star-wound for 6,600 volts, three-phase, 50 cycles, the stator end windings being firmly held to provide against trouble due to short circuit.

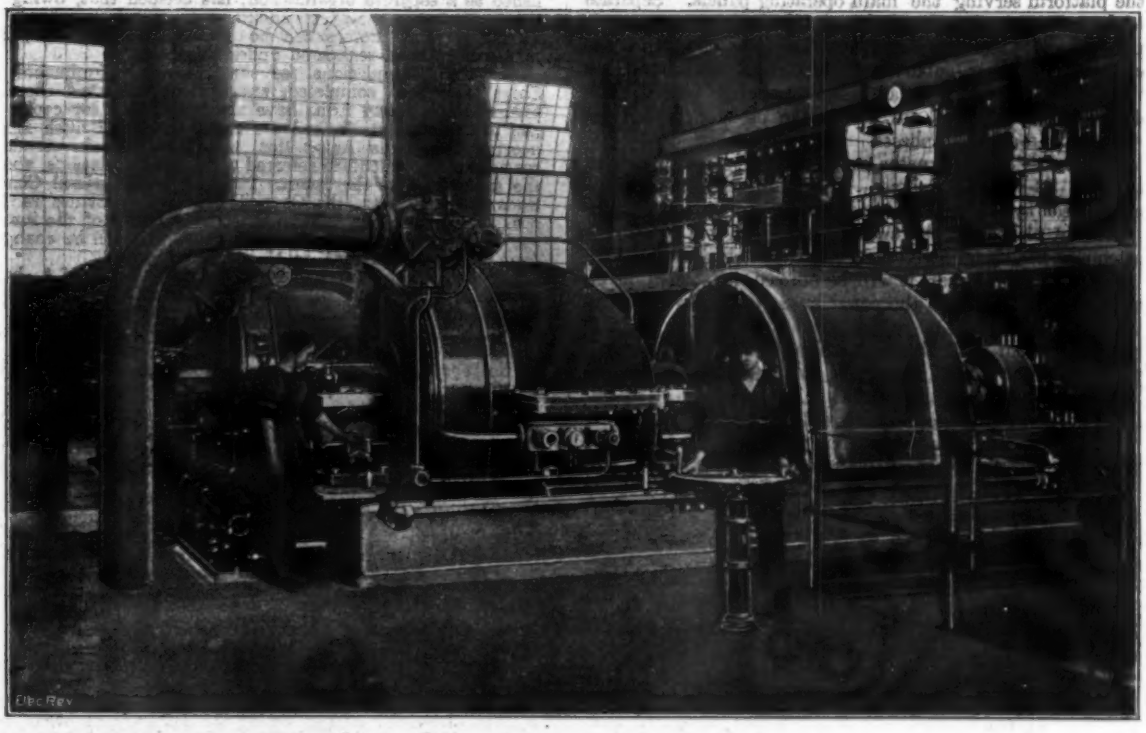


Fig. 6.—Turbine-Room at Gretna Power Station.

The general arrangement of the sets is shown in figs. 3 and 4. It will be seen that the exciters are direct coupled; they are wound for 110 volts.

The 3,000-KW. units have a steam consumption, excluding auxiliaries, of 14·2 lb. per KW.-hour at full load, when supplied with steam at 185 lb. per sq. in., and 500° F. at

the turbine stop valve, and exhausting into a 28-in. vacuum, which is reached with a cooling-water inlet temperature of 75° F.

Each turbine has its own surface condenser, by Messrs. Cole, Marchent & Morley, those belonging to the 3,000-KW. units having an area of 6,300 sq. ft. arranged on the two-flow principle.

An Edwards type, three-throw, air pump, combined with condensate pump, and a circulating-water pump, by the Rees Roturbo Co., both electrically driven, complete the condensing equipment of each set.

The alternator cooling air is passed through a wet filter before use.

Switchgear.—The H.T. switchgear is of the B.T.H. standard cell type, duplicate bus-bars being provided. The oil switches are remote controlled through levers manipulated from the switch platform. The general arrangement of the switchboard is shown in figs. 3 and 4.

The isolating switches are interlocked with the oil switches, and with their respective service doors, in such a manner as to prevent accidents.

A separate panel is provided for each of four generators, six feeders, three transformers, and two Tirrill regulators. The generators and auxiliary transformers are arranged with the Merz-Price balanced system of protection, while the four principal feeders have Merz-Hunter split-conductor protection. All circuits are fitted, in addition, with time overload trips, as well as the usual accessories.

The protective gear mentioned for transformers and feeders has proved very reliable, in that it has isolated satisfactorily on numerous occasions without interrupting the supply over alternative routes.

An accumulator battery, having a capacity of 126 amp.-hours at 110 volts, is provided for tripping the oil switches and for a few emergency lights.

Auxiliary Switchboard.—Current for the station auxiliaries is provided by three 500-K.V.A., 6,600/440-volt, mesh-star, Ferranti, oil-cooled, core-type transformers, two of which are always in circuit.

This power is controlled by a B.T.H. board, placed below the platform serving the main operating panels. Separate leads are run to each of the circulating water and air pumps, and to each side of the boiler house, where the current is further subdivided through a Parmiter-Hope "Fluvent" pattern ironclad-fuse distribution board. The 440-volt L.T. switches are all of the oil-immersed type, with trips in all three phases.

General.—The alternator neutrals are separately earthed through 83-ohm resistances. The alternator excitation is controlled by means of hand-wheels and pedestals conveniently placed on the switch gallery, from which the attendant has an uninterrupted view of the turbine house.

The H.T. switchgear, it will be noticed, is isolated in an annexe, separated from the power house proper by the main wall of the building.

The internal H.T. cable connections are in lead-covered, paper-insulated cable; the L.T. in rubber-covered wire.

The jumpers on to the overhead lines are paper-insulated, lead-covered, served, tape-armoured, three-core cable.

The power and boiler house structures are designed with a view to allowing a 50 per cent. extension, should the need arise.

A 15-ton hand-operated travelling crane runs the whole length of the turbine house.

As a supply of cooling water from the Solway was not obtainable, a 148-ft. by 76-ft. spray cooling pond, to Messrs. Harrison, Son & Jobson's design, had to be installed. It is guaranteed to cool 840,000 gallons per hour, from 90° to 75° F., with a wet-bulb temperature of 55° F. Valves are arranged in the system in such a manner that the active area can be made to suit the station load. It has been found necessary to change the pond water at frequent intervals to avoid condenser scale, which would in time result from excessive concentration.

The water from the pond is taken into the power house through a 30-in. cast-iron pipe, to which the various circulating-water pumps are connected. On leaving the condensers the water again enters a common pipe-line, to be sprayed through some 589 nozzles at a pressure equivalent to a 18-ft. head over the pond area.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

ANNUAL REPORT.

THE annual report of the Institution states that the membership at April 1st, 1919, amounted to 7,023, an increase of 356 on last year's figure; it consisted of eight Hon. Members, 1,524 Members, 3,833 Associate Members, 519 Graduates, 680 Students, and 459 Associates. Of 99 members deceased during the year, 34 gave their lives for their country. During the past 12 months there have been 27 ordinary, 4 informal, and 23 Council meetings; with the addition of meetings of Committees and Conferences, the total number of meetings was 191, comparing with 153 in 1918, 148 in 1917, and 117 in 1916. Before the war the highest number was 159, in 1913-14. There have also been 57 meetings of Territorial Centres. The Students' Section held 8 meetings in London, and the Students' Section of the North-Western Centre also held 8 meetings. Premiums for papers were awarded by the Council as follows:—Institution Premium (£25), Prof. Miles Walker; Ayrton Premium (£10), R. S. Whipple; John Hopkinson (£10), P. Hunter-Brown; Kelvin (£10), S. F. Barclay and S. P. Smith; Paris (£10), R. Knox; extra premiums (£10 each), E. P. Cumberbatch and Lt.-Col. W. A. J. O'Meara. No awards have been made of the David Hughes and Salomons Scholarships. Particulars regarding the Paul Scholarship, to be devoted to instrument-making work, are given.

In view of the success of the Tees-Side Sub-Centre, a Territorial Sub-Centre has been established at Sheffield, and others will be formed at Aberdeen, Leicester, and Preston.

The rules regarding examinations for Associate Membership are temporarily suspended.

The number of members who have served in the Navy or Army since the outbreak of war is 2,021.

The Army Council appointed a Commission to inspect and report upon the arrangements for the supply of electric power in the war areas in France and on future policy in regard to such matters, and on the invitation of the Army Council the Council appointed the President (Mr. C. H. Wordingham) to represent the Institution on the Commission. The Commission spent 10 days in France, examining witnesses, and inspecting various establishments and sites, and presented a lengthy report. The President was similarly nominated to give evidence before a Committee appointed by the Army Council to report upon the future functions and organisation of the Corps of Royal Engineers, presided over by Sir Henry Rawlinson, G.C.B.

The Electrical Appointments Board, which has been established as a separate organisation, has decided that, owing to the limited number of vacancies, only members who have served in H.M. Forces can be dealt with at present; 230 names have been registered under this heading.

The draft Regulations for the Electrical Equipment of Ships have been completed, and will be published shortly; several shipbuilding firms have already applied for copies of the preliminiary draft, and are using it. The British Engineering Standards Association will issue certain standard specifications, which are referred to in the Regulations, about the same time as the latter. In the Model General Conditions for Contracts, the Council has altered Clause 24 for contracts made since 1918 so that the amounts of the instalments of the retention money (Clause 23 (2)) will be changed from 10 and 10 per cent. to 15 and 5 per cent.

The Councils of the Institution and the B.E.A.M.A. have agreed that in future all researches initiated by them shall be carried out by the Electrical Research Committee, which is composed of 7 members from each body, and has appointed Mr. E. B. Wedmore as Director of Research.

The report of the Patent Law Committee was adopted by the Council in June last, and later by the representatives of 30 technical societies.

A Committee has been appointed to report on regulations for overhead power lines, with a view to reducing the unnecessarily high cost, and securing the safety of the public by cheaper methods of construction; the British Engineering Standards Association will prepare specifications for such items of overhead construction as may require them.

The Council has set up a Committee for the purpose of securing technical co-operation between this country and the Dominions and Colonies, and foreign countries, for the exchange of experience and information as to engineering practice.

The Committee of representatives of various interested bodies, appointed by the Council to consider the question of an Electrical Proving House, has prepared a detailed scheme, and the matter is receiving consideration.

The Council took steps to deter the Prime Minister from placing electricity supply under the Ministry of Ways and Communications. A special Committee has been appointed by the Council to formulate a plan to obtain the opinion of members of the Institution on the Supply of Electricity Bill.

The official recognition of the Electrical Power Engineers' Association as the protective association for technical staffs, and the establishment of the Electrical Development Association as the result of the work of the Committee appointed by the Council in 1918, are dealt with in the Report.

On December 31st, 1918, the capital account of the Benevolent Fund stood at £5,709, and the accumulated income at

£1,249. In 1918 the receipts were £259, and 19 grants were made, amounting to £230. A recent appeal to members for support has had a gratifying result, the number of subscribers from January 1st to April 15th this year being 570, and the amount subscribed £422, as compared with 104 subscribers and £133 in the same period last year.

The annual accounts show a margin to the good on the revenue account of £1,271, compared with £2,090 in 1917, a decrease of £819. The assets stand at £134,675, and the liabilities at £42,926, leaving a balance to the good of £91,749, an improvement of £6,969, compared with 1917.

Address to the Territorial Centres.

By C. H. WORDINGHAM, C.B.E., President.

[During the session the President has visited and addressed all the territorial centres. The following is an abstract of the *verbatim* report in the *Journal* for April.]

One of the most conspicuous things we did last session was to improve the status and extend the responsibilities and possibilities of what were then called local sections. Very much more responsibility is now given to the Committees of the Centres, and they are taken fully into the confidence of the Council. In the past the chairman was bound down by promise of secrecy not to tell his committee what passed at the Council meetings, and in consequence was often placed in a most invidious position. That condition has now been done away with, and the chairman is at liberty to communicate the whole of the minutes of the Council to all the members of his committee.

The question of the electrical proving house has now advanced to the stage of a definite scheme having been formulated.

There are one or two questions outstanding which will have to be settled before we can make any real progress. One of these is whether the proving house should test only goods of British (that is to say of Imperial) origin, or whether it should also be prepared to test imported goods and to certify whether they do or do not comply with British standard specifications. It has been suggested that we might have reciprocity in the matter.

In certain quarters we are told support will not be forthcoming unless some arrangements can be made to enforce the use of articles only which have passed the proving house. That is a very difficult matter to arrange, and my own personal view is this—let us get the proving house started and all these other matters will very rapidly settle themselves. I am convinced that once it is on its feet manufacturers and all concerned will find it is of such enormous benefit that they will not hesitate to make use of it. I do not believe in considering every possible difficulty that may arise beforehand. It is far better to get the thing started and deal with the difficulties as and when they arise.

Another important step taken last session was the formation of the Electrical Development Association. I am confident that this association, if properly worked, will have a most important bearing on the industry in the future.

A very important committee was set up last session in connection with the question of patent law, and, under the chairmanship of Mr. Mordey, it produced an admirable report, which was adopted at a conference called by the Institution of Mechanical Engineers. There is reason to hope that full weight will be given to the views expressed in a new Bill which is about to be drafted.

Last session the Council determined to set up what is known as the Appointments Board. This session the Board has actually been appointed, and it is now at work. It will only deal with those who are out of employment, and will endeavour to bring them in contact with employers who are seeking assistants. It will be run exclusively by members of the Institution for members of all grades.

The Institution has formed a branch of the Royal Society of Medicine known as the Association of Radiography and Electrotherapy, a joint committee to deal with the question of providing efficient lay helpers in connection with X-ray and electrotherapeutical work.

Recently a committee, which I think will be very important, has been set up by the Institution, known as the Technical Co-operation Committee, to deal with all questions affecting the Institution which arise from foreign countries. We hope foreign countries will set up committees of their own on similar lines.

At present we are not doing very much as an Institution abroad. In Canada the American Institute has to a very great extent already captured the field, and anything that we do must be more or less in competition with them. It would be lamentable were a similar position to develop in Australia and New Zealand, or in India. We ought to take a very broad view of the matter, and recognise that we cannot expect these great Dominions to be considered as territorial centres, on the same footing as a comparatively small section of the British Isles. We must recognise their national aspirations, and my present view is that each of these Dominions should have its own Engineering Institution, and our members should in some way be affiliated, as a section of this Institution, to what I may call the National Institution. In those countries in which the total number of engineers is small there might be one National Institution for all kinds of engineers; in others there might be enough electrical engineers to justify a National Electrical Institution. In either case our members in the Overseas Dominions while remaining members of our own Institution, and meeting together, should in some way be affiliated to that Overseas National Institution, so that Canadians or Australians or whoever they were would feel that they were not joining a purely English Institution, but that they were joining a Canadian or Australian Institution closely interlinked with our own British Institution of Electrical Engineers. I think it is the duty of our Institution to foster in that way the interests of electrical engineers all over the British Empire, and I think that the matter should be taken in hand forthwith.

What certainly entailed on me personally by far the greatest amount of work last session was the forming of a protective association for power station engineers. Towards the latter end of last year the Council were informed that very strenuous efforts were being made by the Electrical Trades Union to bring within its membership not only workmen but engineers of all ranks up to and including chief engineers of central stations. The Government practically insist upon all industries being organised. The Whitley Report most unfortunately recognises only two classes: workmen and employers. The brains of manufacturing works and of all technical industries are left out altogether. It is a gross injustice and a most extraordinary oversight. You cannot have the technical staffs in the workmen's union. The Council were informed that there were some half-dozen associations intended to be protective associations, but all very much on a par with one another. Having regard to the facts as they were presented to the Council, the Council said: The only way we can reconcile these half-dozen associations is by the Institution starting an altogether new one under its auspices which the members of these other associations can join without any loss of dignity. The only object of the Council was to provide a representative protective association which every one of its members could join. They had no other object in view. When the mass meetings came to be held, however, very violent opposition was experienced from one of these half-dozen bodies, namely, the Electrical Power Engineers' Association. It became quite clear that this association had far out-distanced all the others, and was in fact vastly more important than the remaining ones in respect of numbers and of the support which it had received from the power station men concerned. Further, they had a most important asset in that they were constituted before the outbreak of war as a trade union. In order to act effectually you must be a trade union, whether you like it or not. As soon as the facts were found to be different from the facts which were put before the Council, on which facts they had acted, the Institution recognised the E.P.E.A. as *the* protective association for engineers engaged in the power station industry. And there the matter stands at the present moment.

Now as the Institution has dealt with power station members it has an equal duty to those other members who are engaged in the manufacturing industry, and something ought to be done for them. There is already in existence a society known as the Society of Technical Engineers. There has been a great deal of secrecy about this society, and very little if anything has been published. As a matter of fact, I have been in touch with members of this society practically since its inauguration. For some reason there has been in the past a strong feeling of hostility towards all the old institutions—electrical, civil, and mechanical—on the part of this new society. The society is not purely electrical, it embraces all branches of engineering, and for that reason it has been quite impossible for our own Institution to approach the society because we should have laid ourselves open to a very well-merited snub. Therefore nothing has been done officially, but unofficially I have endeavoured to get in touch with the movement; I am very glad to think that a much better feeling is growing up towards the Institution, and I look forward to co-operation with the society before very long.

There is a good deal to be said for the line they have taken. It has been pointed out to me that in many of the large works you have staffs belonging to quite different branches, and it is important that all the members of the staff of one firm should be members of the same and only one protective association. The matter is urgent, and we should get a single protective association for the whole of our members in whatever branch of electrical work they practice.

It appears to me it might be possible to extend the Electrical Power Engineers' Association so as to include all electrical engineers and to embody it in the Society of Technical Engineers. The E.P.E.A. is very young and it has many young men within it. It may in the earlier stages act indiscreetly at times. It should not be condemned for that; rather should every effort be made to secure that the governance of that body is effected by men who will have plenty of common sense and moderation, and will run it on proper lines; but whatever they do, try to meet them, and do not try to set up competitive organisations which can only end in failure, for any competition must tend to destroy the usefulness of all those who are competing. After all, what we have to fight is a common enemy.

With regard to the E.T.U., we do not even want to fight them. I should like to see some rapprochement between the

union and the E.P.E.A. Hitherto they have been at loggerheads because the E.T.U. has been endeavouring to bring within its ranks those who, properly speaking, ought never to be there. If only these two bodies could agree upon a line of demarcation then there is no reason why one should not be helpful to the other. So long as the E.T.U. endeavour to force engineers into their ranks, so long must they be regarded in a hostile spirit by the engineers, who never can possibly in any numbers, I should hope, enter that union; not because there is anything derogatory in their doing so, but because there is an essential difference between manual work and technical and scientific work.

The next matter which I think ought to receive attention is the doing of something more by the Institution for its junior members. There is a tremendous gap between the students' meetings and the general meetings of the Institution in London and at the territorial centres. I hold most strongly that all technical discussions should be held under the auspices of the Institution. The protective associations should confine their attention to the objects for which they were founded. I think it would be a very great mistake if they were to start reading papers on technical subjects, as has been proposed, but, in saying that, when I was consulted on the matter, I met with the retort that it is essential that these younger men should have the opportunity of reading papers and taking part in discussions, that they were not qualified to join in the main meetings either as authors of papers or in discussions, and if they did not have facilities they would never get the practice which was necessary to enable them to become competent authors and able to discuss papers of the general meetings. That is entirely true, and it is certainly the duty of the Institution to provide those facilities. I felt so strongly about this that I brought the matter before the Council at its first meeting this session, and I am hopeful there will be set up a committee drawn from the junior members of the Institution above the grade of students, but still not very far advanced in the profession, who will arrange for the reading and discussion of papers by men of their own rank.*

At the present time undoubtedly power-station papers greatly preponderate, but they are of very little interest to the telegraph and telephone section. We might very well have a committee for telegraphic work and let the telegraph men organise their own meetings and conduct their own discussions. There is a crying need for good work to be done in connection with wireless telegraphy.† The fact that we have not attended to these lesser known branches has led in the past to the formation of special societies. There ought to be no need for that; they ought to be dealt with by appropriate sections of the Institution.

I should like to commend to you the provision of a worthy, conspicuous, useful, and lasting memorial to those of our members who have fallen in the war. There has been set up a committee which has already held meetings, and has carefully considered the lines which such a memorial should take. I hope that no capital sum will be carried forward in perpetuity, but that the whole of the money collected will be spread over the lifetime of those who are in receipt of the help and no further. The memorial should be of active use to those who have suffered in their own persons or in the persons of their immediate dependents during the war.

I should like also to see the Institution out of its own funds publish a book containing a short biography of every one of its members who has fallen, together with a portrait.

In the brief review I have given you I think two facts stand out. The first is that in several instances papers read before the Institution have led to definite action being taken; that is a gratifying result. The second is that such action has been taken in concert with other bodies. The Institution, as it has been said, has been the umbrella under which a number of other bodies have met. On some six or eight occasions during last session joint meetings of that kind took place. I think this taking the lead has been a most useful and important development of the Institution's work.

In my inaugural address I laid a good deal of emphasis on the obtaining by the Institution of a Charter, and a Charter Committee was set up last session. The committee met once and reported. It was quite clear when the meeting began that the members of the committee thought that what they were expected to do was to draw up a scheme in the form of a Royal Charter having the same effect and the same objects as the scheme which is now embodied in our present Memorandum and Articles of Association, but I ventured to unfold to that committee something of what was in my mind as to the future activities of the Institution, and I am bound to say they were rather taken aback, and the report which they made to the Council was a very reasonable one indeed, namely, in effect that before they were asked to draw up a Charter it would be just as well if they knew what the Charter was to cover—in other words, before they drew up the specification it was necessary for them to know what they wanted. I feel most strongly that I have no right to go to the Council and ask them to draft a Charter on certain lines unless I am able to say that I have what I may call a mandate from the general body of members that the scheme I put before the Council is the scheme the members want. So, entirely on my own responsibility—I want to make quite clear that the Council is in no way responsible for the scheme I am putting forward—I have drawn up a scheme which will serve as a peg on which to hang a discussion, and I am addressing each of the territorial centres in order to bring this scheme before as many individual members of the Institution as possible. That scheme does not profess to be perfect nor complete, but it is sufficient I think to enable members to express a general opinion and to give a guide as to what they want the Institution to be. There are some of the elder members of the Institution who think that the members wish it to be merely a scientific and technical body for the discussion of papers on engineering subjects. The impression which I have received, rightly or wrongly, is that the majority of the members want something very different. They all want that, but they also want the Institution to develop the commercial side of the industry. At this stage I suggest that members should ask me questions concerning the scheme, but I do not ask them to discuss it. When I have been to all the Centres a full report of the address will be published in the *Journal* and in the Press, and after that publication has taken place, each Centre, I hope, will see its way to call a meeting specially to discuss the scheme. The Council is only there to carry out the wishes of the general body of members, and they do not want to force any scheme upon the members; they merely want to do what the members wish.

(To be continued.)

* This committee is now in being, and three informal meetings have already been held.

† The Wireless Sectional Committee is now in being, and two meetings arranged by it have already been held.

NATIONAL ELECTRICITY SUPPLY.

At a special general meeting of the Incorporated Municipal Electrical Association on Friday, May 16th, in London, it was agreed that the Electricity Supply Bill should be amended in accordance with the general resolutions and leading principles set forth below, and detailed amendments were suggested for this purpose. The resolutions have been forwarded to the members of the House of Commons.

General Resolutions and Leading Principles.

That the members of the Association are of opinion that in the national interest generating stations and main transmission lines should be publicly owned and controlled.

Clause 1.—That the Commissioners shall be whole-time officers having no other interests whatever than the special duties which it is proposed to confer upon them under the Bill.

Clause 3.—That the Commissioners should be given more freedom of action (by deleting the words "subject to the approval of the Board of Trade").

Clause 5.—That the Local Authority representation on the District Boards shall be in the majority (and the representatives of companies excluded).

Clause 5 (3).—That the District Boards should appoint their own chairmen, and that the reference to remuneration of members of the Board be deleted.

Clause 5.—That provision be made for the appointment, &c., of officers and servants by the District Boards, as provided for the Commissioners' staff in Clause 1.

Clause 7.—That if part of an undertaking be acquired by a District Board the whole undertaking be taken over if the owner so desires.

Clause 7 (2).—That the method to be adopted for computing depreciation and sinking fund charges and for the payment of local authorities, companies, or persons should be the same, and that special consideration should be given to all cases where capital costs have been provided for out of revenue moneys (Sub-section 2*a* to be modified accordingly, and Sub-section 2*b* deleted, except the proviso).

Clause 9.—(Proviso, authorising consumers to combine to establish a generating station for special purposes, to be deleted).

Clause 11.—That unremunerative areas developed on national grounds should be developed at the national expense.

Clause 12 (2*a*).—(Similar proviso to be inserted, applying to company undertakings.)

Clause 13.—(Amendment extending the clause to other authorised undertakers besides the District Boards.)

Clause 15.—That the Commissioners should be enabled to review agreements relating to the user of water.

Clause 16.—That the powers of a District Board should not be transferable except by special order. (Power to lease undertaking to be deleted.)

Clause 17.—That the compensation clause is unsatisfactory as regards the time limit of five years, the absence of a scale of compensation, and its non-applicability to the officers and servants of undertakings which have not vested in the District Boards.

Clause 24.—That the industry will be severely handicapped unless powers are given to the District Boards and all authorised undertakers to sell appliances on ordinary and hire-purchase terms.

Clause 26.—That expenditure incurred for the purposes of standardisation should be defrayed out of a special fund established on a district or national basis.

Clause 29 (3).—That auditors employed should be professional auditors.

Clause 35.—That the transfer of undertakings or portions thereof to the District Boards should be exempt from stamp duty.

Clause 39.—(Authority to make rules, &c., to be confined to the Commissioners, deleting Board of Trade.)

Clause 44.—That the control of the electrical industry should be placed under that Government Department which most nearly represents all industry and commerce, viz., the proposed Ministry of Commerce or the Board of Trade, the Board of Trade in either case being the appropriate department at the present time. (Clause transferring powers to Ministry of Ways and Communications to be deleted.)

New Clause.—That association for the interchange of information, experience, and ideas is advantageous, indeed necessary; enabling facilities in the case of local authorities should be provided. (Payment of subscriptions to associations, and expenses of attendance at conferences.)

Subject to such alterations and amendments, the Incorporated Municipal Electrical Association considers that the Bill is acceptable to local authorities.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Base Rate and Bonus.

It would appear that a considerable amount of caution is necessary before accepting a post where a fixed sum is named for remuneration inclusive of all bonuses to date. In nine cases out of ten the applicant never troubles to inquire what is the basal salary and what is bonus, the result being that after accepting the post he realises, when too late, that in all probability he has a lower basal salary than he had in the job which he vacated. This "catch-penny" type of advertising ought to be stopped, and in its place a plain statement given as to what is base rate and what is bonus.

Caught in the Net.

May 24th, 1919.

Posts for Demobilised Engineers.

The methods of some of our Government departments make a business man feel tired. If demobilised engineers seeking occupation will write to me, giving, on separate sheet, particulars of qualifications and experience, I will see what I can do in the way of helping them to secure positions.

W. Stanley Shaw (Capt.),
Territorial Force Reserve.

7, Addison Road, Bedford Park, W. 4, *May 25th*, 1919.

The "demobbed" received a further shock at the hands of the Committee at West Ham. No ex-Service man amongst the three selected to appear before the Council. All three in good posts at present.

The Council consists mainly of Labour members, and the meeting was held a few hours after the demonstration near the House of Commons. I enclose card.

Demobbed.

Electricity and the Model Home.

I have just returned from the Model Homes Exhibition, being held at the Central Hall, Westminster, and did not see any electrical exhibits, though our enterprising friends of the gas industry were well to the fore. It seems a great pity this is so, for the exhibition is being attended by people from all over the country who are interested in housing, and when it is remembered that £300,000,000 are to be spent in the next few years on new houses alone, the importance of this sphere of activity should not be lost sight of, but, rather, should be energetically followed up by the electrical industry.

Ernest T. Williams.

London, N.W., *May 22nd*, 1919.

[We cordially agree with Mr. Williams that, of all things, electricity should have been adequately represented at the Model Homes Exhibition. That it was not must be ascribed largely to lack of organisation in the electrical industry. But it will not happen again. Our Electrical Development Association, newly born, is not yet in a position to take effective action—but it is moving, and we shall soon see results.

It has taken three years for Mr. Williams's scheme for the reorganisation of electricity supply to bear fruit in legislative action, but the Electrical Development Association will move more quickly than the Government. Our colleagues in Wales have already shown the way, as will be seen elsewhere in this issue.—EDS. ELEC. REV.]

The E.P.E.A. Award.

Your correspondent "Wessex" asks, in reference to Mr. Harding's colleague, "How can the award apply?" There are many of us who would be exceptionally grateful if "Wessex" would inform us when, where, and how it is applied. For a space of six weeks I have been asking through your columns if anyone has really seen one of the fortunate individuals who have obtained the award, or if any person or persons can vouch that they have either seen or had speech with one of these very remarkable phenomena.

All the satisfaction received so far is a reply from Bath, which omits to state definitely that the increased salary, *plus* the lump sum due from March 31st, 1918, has been received. In to-day's issue (May 23rd) we have, in another letter, a copy of the protest of some persons referred to as the A.S.E., and the E.T.U., against some rather irregular doings at Southampton.

We have no record that another body, known as the E.P.E.A., has made any public protest on the same matter, though the irregularity in question affects the members of the E.P.E.A. to a far greater extent than the members of the other bodies mentioned. Is this fact due to funk, neglect, or to a feeling that it would be *infra dig.* to refer to such delicate matters, and by so doing to wound the tender feelings of some chief engineer or committee-man?

One would have thought that the affair at Southampton would have been of prime interest to the E.P.E.A.; but then, one also thought that business was really intended when the 20 per cent. + £90 award was declared as the Association's firm policy, which it would carry at all costs.

Perhaps, however, one is a little hard on the E.P.E.A.; perhaps insufficient time has been allowed to our officials to permit them to follow the E.T.U. at a respectful distance, either in the matter of the phantom award or that of the cushy little berth at Southampton. No doubt in a few months' time we may get one-tenth of what we ask for, and no doubt our next annual report will contain a note on Southampton to the effect that "Your Council and Executive Committee had their attention called to this matter, and its gravity almost demanded a word of protest. We are glad to report, however, that wiser and calmer counsel prevailed, and our corporate indignation was fully expressed by an extreme and dignified silence."

Mr. Harding is quite right in asking if this award is backed by any authority, or whether it is simply a pious opinion expressed by a pseudo-authority for the comfort and encouragement of a crowd who most emphatically "Don't want to fight," and will be jingoed if they do.

Connaught T. Smith.

May 26th, 1919.

With reference to recent correspondence on the above Association and its "awards," might I venture to add one word further? The E.T.U. provides a section for station engineers, and I would strongly advise all shift engineers and stations engineers and others now of the E.P.E.A. who are dissatisfied with the *promised* award not to adopt the Asquith attitude of "Wait and see," but to communicate with the nearest delegate or secretary of the E.T.U., and first obtain particulars of the Station Engineers' Section, second join up, third fight on, and last, but not least, obtain the victory assured to all E.T.U. members, for I believe the E.P.E.A. to favour the Wilson theory of "more notes," but no tangible result other than waste of paper and ink. The award, I am afraid, is like the old saying of to-morrow—it never comes.

Change-Over.

May 25th, 1919.

Pure v. Vulcanised Rubber for Flex.

Having had several friendly arguments with other engineers on the question of superiority, in use, of either double-pure-rubber-covered flexible wire or double-vulcanised, I should be interested to hear the opinion of your readers. From my own experience, I consider that whilst vulcanised flexible has the advantage of higher intrinsic resistance at the outset, it rapidly deteriorates, especially when used with counter-weight fittings, electric irons, and other portable apparatus. In my opinion, the better material to use is pure rubber. I am aware that vulcanised flexibles are more usually specified by consultants, but I think without due consideration to the results in use.

J. Robinson.

May 22nd, 1919.

[The I.E.E. Wiring Rules distinctly favour pure rubber.—EDS. ELEC. REV.]

Flexible Copper Tubing.—Rubber tubing does not fulfil all the conditions of a satisfactory elastic gas connection. The Metal Gas Hose Co., of Erie, Pa., has produced metal tubing which is said to meet some of the requirements which rubber tubing fails to satisfy. It is made of seamless, soft-annealed copper, in lengths from 12 to 36 in., and in ¾-in. diameters. It is sufficiently flexible to make it readily adaptable to portable appliances, yet durable to a degree that justifies the manufacturers in recommending it for permanent installations. The cost of such tubing is by no means prohibitive.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Automatic Valves for Motor-driven Air Compressors.

Heretofore, in driving motor-driven air compressors, no efficient and inexpensive method has been found that would automatically unload the compressor before starting and stopping the driving motor, and thereby reduce the wear and tear of the plant. Further, when the consumption of air is small relatively to the capacity of the compressor, it would be economical automatically to stop the motor when the pressure in the receiver rises to a certain predetermined maximum, and start it again when the pressure falls to a predetermined minimum. On the other hand, when the consumption of air approximates to the full capacity of the compressor, it would be preferable to run the motor constantly, unloading and loading the compressor at the maximum and minimum pressures respectively.

The above results may now be obtained by the use of the patented magnetic air valve of the British Thomson-Houston Co., Ltd., of Rugby, in conjunction with their automatic starting gear.

The magnetic air valve ensures that the air compressor is unloaded before current is switched on to the motor, as well as throughout the starting period, the load being thrown on only when the motor has reached its normal speed. This considerably reduces the current required at starting, and permits a starting gear of lower capacity to be used than would otherwise be necessary. The valve operates similarly when stopping the motor, unloading the compressor before current is switched off. This enables the compressor and motor to slow down gradually, and prevents undue strains on the heavy moving parts.

In order to run the compressor continuously, a small switch is closed, the load then being automatically removed when the air pressure rises to the maximum, and thrown on when it falls to the minimum.

In whichever manner it is determined to operate the compressor, either intermittently or continuously, no further attention is required after closing the main switch, the subsequent operations being entirely automatic.

Apart from the economy of current and compressed air, the smooth working of the compressor due to the absence of severe strain at starting and stopping conduces to a minimum of wear and tear on the compressor, the life of which should be considerably lengthened and repairs reduced to a minimum.

The essential parts are a pressure governor, contactor starting gear, magnetic pilot valve, time lag device, and lever switch. A main unloading valve and a non-return (or check) valve are also required, placed on the delivery side of the compressor, these being part of the compressor equipment.

The magnetic air valve is a combination of an electromagnet of the contactor type, a two-way valve, and a small switch controlled by a dashpot. These parts are such as have been commonly used on B.T.H. contactor panels, or in steam locomotive practice, and have demonstrated their reliability in actual use for years. They are supported on a slate base with corner feet for bolting to a vertical surface.

The diagram (fig. 1) shows the compressor at rest and the receiver fully charged; valve v^1 being open admits air from the receiver to the unloading valve, thereby opening the compressor cylinder to atmosphere.

When the demand for air is such that the pressure in the receiver falls to a predetermined minimum, the pressure governor switch A closes; this energises and closes the auxiliary contactor B, and and interlock C attached thereto. Current then passes by way of interlock C to the main coil D of the automatic starting gear and starts the motor.

The starting contactors are omitted from the diagram for the sake of clearness. Each contactor operates under current-limit control, *i.e.*, the second contactor cannot close until the starting current, which had risen when the first contactor closed, has fallen to a predetermined figure, and so on during the complete operation of starting. As yet the pilot valve solenoid F is not energised, its circuit being interrupted by the interlock E attached to the last main contactor; the valve v^1 of the pilot valve therefore remains open, and air passes from the receiver to the unloading valve.

At the same time as the last contactor closes, cutting out the last section of the resistance, the motor having then attained full speed, the interlock E closes, current then passing to the pilot valve solenoid F which closes, thereby forcing down the rod G, closing the upper valve v^1 and cutting off the supply of air from the receiver. At the same time the valve v^2 opens, and the air contained in the unloading valve is free to pass through the pipe H, the lower valve v^2, and out at the opening J. The unloading valve now closes, loading up the compressor; it will be seen that the load is not applied until the motor is up to speed. The closing of the pilot valve solenoid F also closes the interlock K in parallel with the interlock C.

When the demand for air decreases and the pressure in the receiver rises to the predetermined maximum, the pressure governor switch A opens, thus opening the auxiliary con-

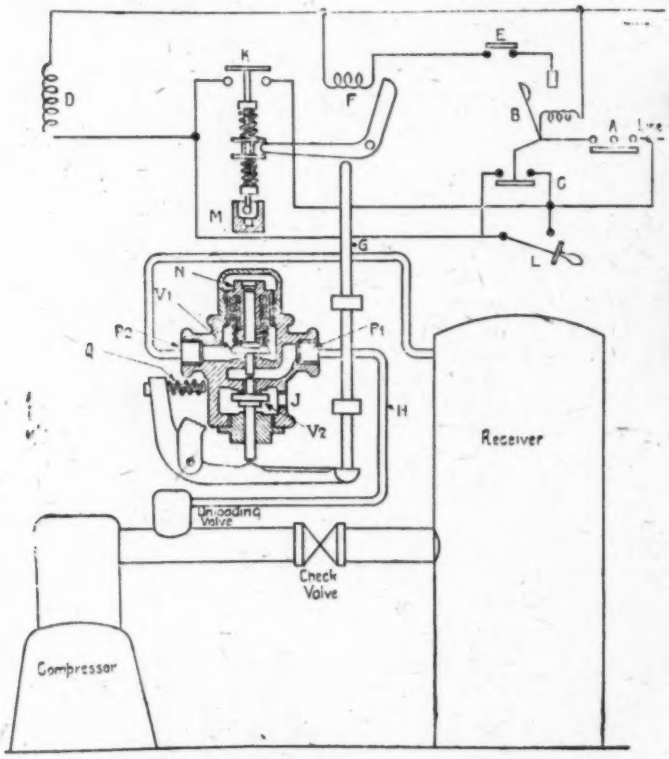


Fig. 1.—Diagram of B.T.H. Magnetic Air Valve for Air Compressors.

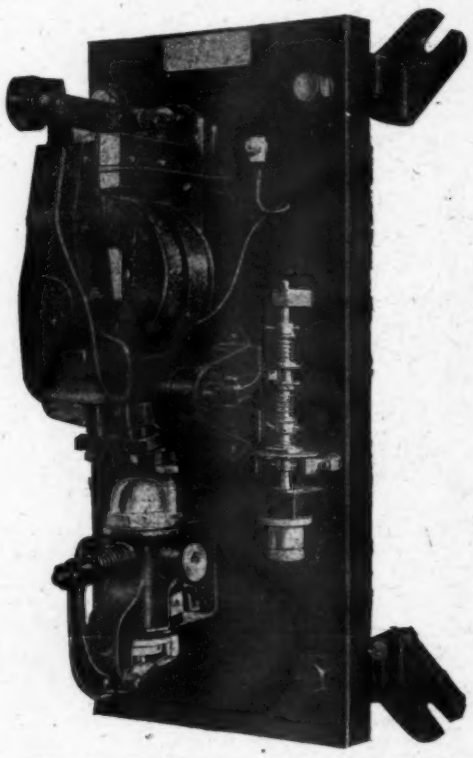


Fig. 2.—B.T.H. Magnetic Air Valve.

tactor B and the interlock C; the pilot valve solenoid F is therefore de-energised, the rod G is forced upwards by means of the spring Q, the lower valve V^2 closes, and the upper valve V^1 opens. Air from the receiver then passes once more through the valve V^1 to the unloading valve, which opens, thereby unloading the compressor.

During this period the main contactors are not affected, being kept closed by the interlock K, the movement of which is delayed by the dashpot M. After a predetermined period of time has expired, this interlock opens, tripping the main contactors and stopping the motor. It will be noted that the motor is not stopped until the compressor has been unloaded.

By closing the lever switch L the compressor will run continuously, the pressure governor A then having no effect on the main contactors D, but only on the unloading valve through the operation of the pilot valve, the compressor being loaded or unloaded at the minimum and maximum pressures respectively.

When large multi-stage compressors are used, involving the use of intercoolers and much piping, the continuous loading and unloading of the compressor means a considerable loss of compressed air. In these cases it is recommended that two air valves be used instead of one, the first air valve operating on the air intake side of the compressor, and the second one on the delivery side. As an interval of time elapses between the operation of the two air valves, *i.e.*, between the closing of the intake and the opening of delivery, the compressed air contained in the system is allowed to be forced through to the receiver before unloading takes place, so that when the delivery side is opened to atmosphere, it is practically at atmospheric pressure.

B.T.H. magnetic air valves are made for pressures up to 300 lb. per sq. in., an adjustable spring being provided for adjusting to the pressure required. They are made in two types for A.C. and D.C. circuits respectively, and to suit voltages up to 550. Magnetic air valves are supplied either as separate units, or may be combined with a pressure governor on the same base.

"Simplex" Heaters.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, have just placed upon the market two new designs of lightly-loaded heaters, suitable for portable and auxiliary heating. Both types are supplied complete with flexible cord and lampholder adapter. The reflector type, known as the Plexsim "Firette," is loaded to 600 watts, but the conical element being highly radiant, the heat emitted is much greater than would be expected from so low a loading, making this particular pattern suitable for use in cold rooms where the heater can be placed in proximity to the person desiring warmth.

Figs. 3 & 4.—Simplex "Firette" and "Onebar" Fires.

The cabin type, known as the Plexsim "Onebar" fire, consists of a robust cylindrical iron case with open perforation on one side, in the interior of which is a Plexsim luminous fire-bar, loaded to 500 watts. The heater is very strong, and will stand rough usage; the bar being suspended on springs is practically unbreakable through shock. It is particularly suitable for ships' cabins, small offices, cubicles, crane cabins, and the like positions; but it is also useful for domestic purposes, the position of the luminous bar being adjustable so that it can be arranged for fixing to wall or floor, and it is also useful as a portable heater.

French Standardisation of Electrical Machinery.—With a view to standardising as much as possible general practice in relation to the construction of electric generator sets, the French Chamber of Electric Power Machinery Constructors and the Steam Turbine Manufacturers have published rules and data relating to the design and manufacture of these machines. The most important data are included in an article in the *Revue Générale de l'Electricité* of April 5th, 1919. The technical section includes formulæ, data, diagrams, and tables dealing with the standard definitions of the power notation used, and the figures corresponding to these definitions for turbo-alternators of 50 periods, from 350 KW. to 35,000 KW., and also for turbo-dynamos are given. The commercial section of the article consists of a very complete selling specification. The explanatory notes at the end amplify a number of the sections which may not be sufficiently clear to all readers.

LEGAL.

King *v.* City of London Electric Lighting Co., Ltd.

In the City of London Court, on Tuesday last week, before Mr. Registrar Wild, a claim was made by Mr. A. P. King, 10, Pancras Lane, against the City of London Electric Lighting Co., Ltd., for the balance of money belonging to the plaintiff in the possession of the defendants and lent to them. The claim was not disputed. The defendant company's representative said the case was one in which he submitted costs should not be recovered by the plaintiff. Every effort and endeavour on the defendant company's part had been made to refund the balance due to Mr. King. The defendants' witness said the money was waiting for him at their office, and he did not give them the opportunity of finding him at his office during the recognised business hours.

The Registrar pointed out that a debtor must seek out a creditor. He could not deprive the plaintiff of his costs except for some cause, and the plaintiff was only exercising the right he had in going to Court. Directly the money was due the person could sue for it. In making an order for the defendants to pay within 14 days, he declined to treat them differently to other debtors.

A Miner Fined.

At Bishop Auckland Petty Sessions, last week, Frederick Jackson, a miner, was charged under the Coal Mines Act with conduct likely to endanger life.

On behalf of the prosecutors, Messrs. Bolckow, Vaughan and Co., it was stated that while in Westerton Colliery accused pushed in an electric switch and turned on the current where boys were working. One apprentice was severely injured by shock. Jackson had no authority to touch the switch, above which was a notice stating that men were working on the line at the time.

A fine of £5 was imposed.

Osram Robertson Lamp Works, Ltd., *v.* Cryselco, Ltd.

In the Chancery Division, on May 23rd, before Mr. Justice Younger, the Osram Robertson Lamp Works, Ltd., moved for judgment in their action against Cryselco, Ltd.

Counsel for petitioners said this was a motion for judgment by consent in a patent action.

The defendants appeared by counsel and consented, and his Lordship made the order.

Wood *v.* Connolly Bros., Ltd.

In the Chancery Division, on May 23rd, Mr. Justice Younger had before him a motion in this debenture holders' action.

Mr. Clanson, K.C., said a receiver was appointed, and an order for sale made, some five years ago, but the war intervened, and the sale could not be effected. Throughout the war, however, a very lucrative business had been carried on for the Ministry of Munitions by the company, under Messrs. James and William Connolly, acting under the receiver. It was now alleged by plaintiff that one of these gentlemen was employing a person named Flannery to come at surreptitious hours and copy drawings with a view to using them in such a way as would not be to the interests of the debenture holders. He therefore asked for an injunction against all three to restrain this being done.

Mr. Archer said what the Messrs. Connolly had done they conceived they had a perfect right to do. Their desire was to act perfectly honestly and straightforwardly throughout. He would give an undertaking not to take away or make or use any such plans or designs.

On this undertaking the motion stood over.

A Dublin Tramway Workers' Award.

Mr. Justice Moore, in the King's Bench Division of the High Court of Ireland, Dublin, ordered notice of motion to be served on the Amalgamated Association of Tramways and Vehicle Workers' Federation in the matter of an arbitration between the Dublin United (Electric) Tramways Co. and their workers, the question arising on an application to have the arbitration made a rule of Court.

Counsel for the Tramways Co. explained that Sir Plunket Barton, in an award of last October, gave the tramway workers 2s. over pre-war wages, and that later the Temporary Wages Court granted an increase from 2s. to 2s., also altering the payment on time basis from a 7-day to a 6-day week. This latter alteration being as the Tramway Co. was advised, *ultra vires*, they made the present application as a preliminary to asking that the award as to the time basis be set aside.

German Institute for Weak-current Technology.—An institute for weak-current technology (in distinction to heavy-current technology), with a professorial chair, has been formed in connection with the Dresden Polytechnik. The curriculum will include telegraphy, telephony, wireless telegraphy, and the theory of instruments, measurements, and transmission lines.—*E.T.Z.*

THE ELECTRICAL EQUIPMENT OF THE NEW MODDER CIRCULAR-SHAFT SECTION.

From the description of the plant of the New Modder Circular Shaft Section in *S.A. Mining Journal and Engineering Record*, we take the following account of the electrical equipment. The power supply to the circular-shaft plant is taken from the Rand Mines Power Supply Co., Ltd. Two independent sets of overhead lines are brought into the sub-station through isolated high-tension switches. The power is delivered at 40,000 volts and transformed down to 2,000 and 500 volts for supply to the motors. The 500 volts is again transformed down to 200 volts at suitable points for lighting purposes. The supply to the mine is controlled by 22 feeder switch panels; six for the 500-volt supply and sixteen for the 2,000-volt supply. The 2,000-volt end of the switch house is divided into two distinct sections, the main bus bars being connected by heavy links, each section being independently fed from the Power Co. The 5,000-H.P. Ward-Leonard winder, air compressors, ventilating fan, underground pumps, winders, and winches are supplied with power from one section, while the whole of the surface works are supplied from the other section, thus enabling the mine officials to close down either section without interfering with the other. All cables are of the 3-core, paper-insulated, lead-sheathed and steel-armoured type. Steel tape armouring is used for surface cables, and steel wire armouring for the shaft cables. The copper section varies from 0.25 sq. in., the largest, to .025 sq. in., the smallest used. Feed cables connect the main switch-house switch panels with four distributing link houses, each to control a section of the plant. Each link house is divided into three sections, each one to control either the 2,000-volts, 500-volts, or 200-volts lighting supply. The power is supplied from each link house to the motors in that particular section of the works by cables leading through local link cages to switch boards controlling complete sections or single switch panels controlling isolated motors. A single-section cage contains six links, two cable end boxes and bus-bar.

With the exception of the two 2,000-H.P., D.C. motors on the main winding engine, all the motors are A.C., three-phase, 500-volts up to 50 H.P., and 2,000-volts from 50 to 5,000 H.P. The motors are of both the slip-ring and squirrel-cage (short-circuited rotor) types. The squirrel-cage type of motor has been taken more advantage of than previously, and in every instance where the starting torque required was within the limits of the short-circuited rotor the squirrel-cage motor was used. When possible, former or semi-former wound coils are used, especially impregnated to prevent moisture penetrating the windings. Both ends of the stator windings are brought out to terminal boxes mounted on the stator frame; this is not only beneficial for testing, but permits of the motor being used with right-hand or left-hand cable leads when moved from one position to another. In the case of slip-ring motors a heavy type of brush gear is adopted, and all brushes are fixed above the horizontal centre line of the rotor. In many instances brush raising and short-circuiting gear has been avoided to save maintenance, by adopting an iron-clad short-circuiting switch mounted upon the outside of the stator frame. When motors are mounted upon stagings, special rigid construction has been resorted to, to prevent vibration. In the case of slip-ring motors, the usual three-phase liquid starter with dipping blades is used. But with the squirrel-cage motor the auto-transformer type of starter is used, connected to the motor by suitable tappings to give the required voltage reduction.

Great care was taken to place the sub-stations at the centre of the load, and the K.V.A. feet to the reduction works centre is equal to the K.V.A. feet at the winder room load centre. Power is distributed in bulk to the various link houses and then sub-distributed to the various link cage centres. Each main link house is arranged so that by means of indicating apparatus and change-over links, various sections may be connected to various cables. There are no inter-connecting cables used. All switch cables, links, &c., are numbered, lettered or tagged in such a manner that by means of standard distribution prints which are placed at all supply points, the operator is able to see at a glance the source of supply and trace out any cable or other connection to enable him to operate with safety. All shaft cables are of the 3,300-volt class, and all surface cables are of the 2,200-volt class. All lighting cables are also of the 2,200-volt class. Each feeder panel and main motor control panel has been equipped with test panels, so that check meters may be inserted when required. All main supply feeds are in duplicate, the cables being so arranged (wherever possible) that the supply to one point is carried over two cables, both of which are normally loaded, but if one cable should develop a fault, the other cable can in most cases carry the load with a 90 deg. F. temperature rise.

The supply to the mine is metered at the sub-station; each independent feed from the Power Co. is measured separately by three independent meters, viz., the consumer's meter, the Power Co.'s meter, and a joint meter, the average being taken of the three readings, provided the accuracy of each meter is within 2 per cent. of the mean accuracy of the three meters.

BUSINESS NOTES.

Catalogues Wanted.—Messrs. Oxley, Lawrence and Co., Ltd., of 60/61, Blackfriars Road, London, S.E. 1, desire to receive copies of trade catalogues.

Mr. Frank A. Meggitt having recently commenced business as an electrical engineer and contractor at 18, Brunt's Street, Mansfield, will be glad to receive trade catalogues.

Machine Tools, Wood-working Machinery, and Treadle-lathes Orders.—The Ministry of Munitions has suspended, as from May 23rd, the operation of the following Orders:—Machine Tool and Power Machinery Order, 1916, Wood-working Machinery Order, 1917, and the Treadle-lathes Order, 1918.

Import Restrictions.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the Prohibition of Imports:—

The restrictions on the importation of the following articles are to be removed:—Aluminium powder, paints and enamels (from July 1st).

The importation of the following articles is to be licensed only exceptionally, as and when required:—Blow lamps, metal parts of lamps.

Industrial Administration.—Mr. Edward T. Elbourne, author of "Factory Administration and Accounts," will give during June and July, at Winchester House, Old Broad Street, E.C., three courses of eight lectures on Factory Organisation (Wednesdays, 6 p.m., commencing June 4th), Labour Administration (Thursdays, 6 p.m., commencing June 5th), and Factory Costing (Fridays, 6 p.m., commencing June 6th). A discussion will follow each lecture. The fee is one guinea for each course. A syllabus can be had on application by post to Messrs. Brindley & Elbourne, 110, Victoria Street, Westminster, S.W. 1.

The Germans and Russian Business.—The Germans continue to have their eyes fixed on possibilities in Russia. According to a German newspaper, the Russian-German Financial Syndicate is being formed in Berlin for the promotion of financial undertakings in Russia. The promoters and managers are Dr. Friedlich (Russian General Radio Telegraphy Co. and the Russagan Telephone and Telegraph Connections Co.), Exporter Beyer, of Rostow on the Don, and Consul Bienemann, of the Union Bank of Moscow, whilst Councillor of Justice Tiktin, of Berlin, is to be the secretary.

The Lead Market.—In their report, dated May 24th, Messrs. James Forster & Co. state:—

On Tuesday afternoon the price of controlled lead was reduced 20s. per ton to £24 nett *ex* warehouse. There may be good reason for the reduction, but it is certainly not known to the trade or the market, and . . . it has naturally shaken confidence and caused the withdrawal of inquiries which were about, both from the home trade and for export.

On the very day of the reduction the market was firm, with actual buyers for June shipment lead at £24 10s., and no sellers under £24 15s. . . . The trade and brokers are nonplussed at the action of the Controllers.

Messrs. G. Cawson & Co., in their report under the same date, say:—

After opening steady at £24 10s. to £24 15s., with business done at £24 10s. May, June and September, the market was upset on 20th inst. by the Control suddenly reducing their price for warehouse lead to £24. This reduction coming when the trade had apparently settled down to the price of £25, and were coming forward to supply their requirements at this figure, naturally destroyed confidence, and, instead of encouraging business, had just the reverse effect. Consumers are now less keen to buy, and argue that if Control take £24 to-day, they may, perhaps, take £23, or even £23 next week. With such a prospect before them, they cannot be induced to buy except for actual requirements. America is now quite out of the market, and the price there considerably above the London parity. Germany, however, is reported to have sold a fair quantity to Holland at cheap prices—this is a fresh competition, which cuts out the London trade. We are afraid that the outlook at present is not very encouraging. Arrivals are again fairly heavy, and stocks may, perhaps, show a further increase. Australia, too, shows some uneasiness with her store of probably 80,000 tons. Relief can only come from improved trade, or considerable reduction in production.

Official Receivership in Bankruptcy.—The Board of Trade has appointed Mr. Arthur Harold Ward to be Official Receiver in Bankruptcy for the districts of Exeter, Barnstaple, and Taunton as from June 2nd, in succession to Mr. Arthur Edward Ward, resigned.

The Overseas Trade Department and British Advertising Abroad.—H.M. Commercial Counsellor at Rome has called attention to the great number of trade advertisements in the Italian Press inserted by foreign exporters other than British, as compared with the practically complete absence of any notices regarding British goods. It is suggested that this matter should receive careful consideration from manufacturers and merchants in the United Kingdom. *The Board of Trade Journal* states that lists of advertising agencies and of suitable Italian newspapers can be furnished by the Department of Overseas Trade, who will be glad to help any British firm who may have difficulty in connection with the publication of their advertisements. The *Journal* further states that the "Department of Overseas Trade is prepared to indicate to high-class British firms an exceptional opportunity of advertising in Turkish, Arabic, and Persian-speaking countries by means of a fortnightly illustrated paper. Advertisements can be accepted for whole, half, or quarter pages. Pictorial advertisements of a striking type (photogravures) are recommended."

The Kinematograph Trade.—In their report for the year ended January 31st, 1919, the directors of Cinematograph Theatres, Ltd., state that though the "Picture House" continues to grow in public favour, running costs are much heavier. There is a substantial increase on last year's profits, and the total dividend for the year is 20 per cent. Out of the available profit balance £12,500 is put to depreciation of properties, £7,500 to depreciation of plant, £15,000 to reserve for postponed repairs and renewals, and £15,000 to general reserve. After paying the dividend referred to above, £25,134 is carried forward. After exhaustive examination of the subject, the directors consider that to maintain the company's present predominant position in the kinema trade it is desirable in most cases to build theatres and cafés in future on a larger scale. For this purpose properties have been purchased at Edinburgh, Nottingham, Plymouth and Hull, and negotiations are proceeding elsewhere. The capital is to be increased from £400,000 to £1,000,000. This important concern is well known to the electrical trade, and its enlarged operations are, therefore, of particular interest. As a matter of fact, the company purchases some 2,000,000 KW.-hours per year from various supply authorities, and, of course, buys considerable quantities of electrical plant, equipment, accessories, &c. Mr. R. Grierson, now demobilised, is back in harness again as chief engineer of the undertaking.

Boys' Welfare Association.—Prince Albert, as President of this Association, attended a general meeting of the members held at the Central Hall on May 22nd, to discuss the enlargement of the scope of the Association. On the motion of Sir W. Beardmore, it was resolved that the objects of the Association be extended to benefit, if so desired, all persons employed in industry, and Sir William referred to the unsettlement in the Labour world as a now outstanding problem of Industry, the solution of which obviously lay in the revival of the old friendly relations between masters and men. Democracy was justifiably claiming a greater share in the affairs of the nation; but it still needed guidance, and it could best get that amongst its industrial surroundings. The Association was established, as the outcome of a conviction on the part of the members of the Council that the wise upbringing of the boys was the most important matter to be undertaken, and that to ensure its success the work must be directed by Industry itself. The Association had been warmly taken up by many of the leading firms of the country, and, in spite of the disadvantages and uncertainty of the present day, had made wonderful progress. There was at present, however, a danger of employers becoming confused between the various claims of the many agencies which had now taken up welfare work. Many employers, also, had come to the conclusion that it would be better for all workers to be dealt with together and not separately. Further, there was little doubt the non-acceptance of the responsibility for the work by the employers themselves would lead to its being taken up by the State, with the inevitable chilling out of the human element. The Council, therefore, after careful deliberation, had recommended the policy embodied in the resolution. Sir George Carter, K.B.E. (Cammell, Laird & Co., Ltd.), having seconded, and the Rev. R. R. Hyde, the director of the Association, having explained the manner in which it was proposed to give effect to the resolution, it was put to the meeting and carried unanimously.

Under the amended constitution, the Association will in future be known as "The Industrial Welfare Society."

Spanish Companies.—The Basque Motores, Ltd., has been formed at Bilbao by James Keid and Sebastian Luis Carcaux y Sturgeon for the manufacture and sale or letting on hire of all kinds of motors, also of internal combustion motors. Capital 50,000 pesetas.

The Spanish company which has been formed to make and sell the specialities of Messrs. Babcock & Wilcox, Ltd., in Spain, has placed orders in England for the greater part of the machinery to be installed, to the estimated amount of 3,500,000 pesetas. It has also entered into commercial agreements with the British Mannesmann Tube Co., Ltd., G. & J. Weir, Ltd., and Lassen, Sons & Menzies, giving it exclusive rights for the sale and manufacture of the specialities of these firms in Spain and Portugal.—*La Energia Electrica.*

Spanish Railway Construction Work.—In the report for 1918, presented at the yearly meeting in March last, of the Metropolitano Alfonso XIII—the underground railway now under construction in Madrid—it is pointed out that, with a view to keeping its character essentially Spanish, almost the whole of the construction material had been bought in Spain; only those articles were acquired abroad which were impossible of acquisition in Spain. These last included copper, coach bogies, and electric motors with their steering apparatus.

The Industrial League.—On the roll of membership of this League there are now between 300 and 400 firms, many managers, foremen, shop stewards, and workmen. By means of meetings, literature, &c., it is working assiduously for industrial harmony, and it has been successful in bringing into closer touch, and therefore better understanding, many employers and employed. Firms in the electrical industry who have not yet joined the organisation should apply to the Secretary, Mr. John Ames, at the offices, 66, Victoria Street, London, S.W. 1, for pamphlets setting forth its objects, and for copies of the *Journal* of the League.

Strike at Turin.—The whole of the nickel working and mechanical works of Turin have been brought to a standstill by a strike of the heads of the technical departments. Some 40,000 workmen are affected. The technicians ask an increase on their salaries corresponding to the advance granted to the workmen.

Letters from the Forces.—According to announcement by the War Office, letters are no longer to be addressed B.E.F. The British Forces in France or Flanders are to be addressed—"British Troops in France," and those with the British Army of the Rhine —"British Army of the Rhine." The "British Salonika Force" now the "Army of the Black Sea."

French Companies.—Under the style of the Electro-Construction a company has been formed at Paris, with a capital of 225,000 fr., for the exploitation of a speed-changing gear applicable to electric motors, suppressing belt transmission, &c.

The Société Grenobloise de Fournitures Industrielles d'Electriques has been formed at Grenoble, with 60,000 fr. capital, with objects as stated in its title.

Monin, Guillard et Jaloustre is the title of a newly established company devoted to the manufacture of instruments and apparatus of precision of all kinds, mechanical, physical, electrical, chemical and medical. Its capital is 300,000 fr., and its offices are at Paris.

The Société Française Radio-Electrique have increased their capital from 1,500,000 fr. to 7,000,000 fr.

The Société de Chauffage Electrique Domestique et Industriel is the title of a concern just started in Paris, with a capital of 140,000,000 fr., its objects being the making of, and trading in, electric apparatus, especially those for heating purposes.

Conference of British Manufacturers.—The National Union of Manufacturers is holding a conference of British Manufacturers to-day (Friday) at 2.15 p.m., in the Central Hall, Westminster, to make definite and urgent representations to the Government that the present widespread unemployment, with the vast sums which are being paid for unemployment pay, is largely due to the uncertainty as to the future economic policy of the country, and the absence of any definite steps for the prevention of dumping and the protection of key or essential industries in fulfilment of the promise made by the Government at the General Election.

Sir Edward Carson, M.P., will address the meeting, and the following will also speak:—Mr. George Balfour, M.P., Mr. Neville Chamberlain, M.P., Sir Richard Cooper, Bart., M.P., and Mr. Alexander Johnston, J.P. The chair will be taken by Mr. George Terrell, M.P., president of the National Union of Manufacturers. It will be exclusively a manufacturers' conference.

Machinery and Plant for Disposal.—By order of the Disposal Board Ministry of Munitions, the Controller of Plant and Machinery is inviting offers for machinery and plant (including generators, dynamos, and motors), at the R.E. Experimental Station, Wembley. Full particulars are given in our advertisement pages to-day.

International Exhibition at Bombay.—According to *Indian Engineering* a movement has been set on foot for holding an International Industrial Exhibition on a grand scale in Bombay next year.

British Westinghouse War Relief.—In a letter recently circulated, the Committee governing the Westinghouse War Relief Fund express their great appreciation and thanks to all contributors for the voluntary support given throughout the period of the war. Up to the end of December, 1918, nearly £66,000 had been subscribed, approximately two-thirds by the employés, and one-third by the company. The period of regular contributions from wage or salary is now about to finish, and it is satisfactory to learn that a balance remains sufficient to cover for a period of at least 10 years the relief of the disabled and the dependants of those who have made the supreme sacrifice. There are 207 relatives and 382 children of deceased workers, in addition to many disabled soldiers and sailors for whom responsibility has been incurred.

Importation of Rubber-Covered Wire into Australia.—The Commonwealth Government has issued a proclamation prohibiting the importation of rubber-covered wire, unless it complies with certain specifications and conditions. To each coil of wire must be affixed a label setting out the manufacturer's name and address, the length of wire in the coil, the date of manufacture, the gauge of conductors, and the insulation resistance. The conditions of tests that the different grades of wire must comply with are set out in the proclamation. The proclamation is published in the Commonwealth *Gazette*, dated April 3rd, and the regulations come into force on July 1st next.—*Industrial Australian and Mining Standard.*

Commenting on the matter, the *Melbourne Age* for April 4th says:—"For some time it has been required by the Customs authorities that all imported rubber-covered wire cable must bear certain specified marks, and must conform to the standards implied by those marks. The Minister of Customs stated yesterday that certain exporters from at least one country decided that they would not mark their cables with any token of standard, and, as a result, cables were being imported into Australia which were unsafe. This had led to the fusing of wires in some cases, and to outbreaks of fire. In consequence, a new Customs proclamation had been issued forbidding the importation of cables unless they bore specified marks revealing their standard of quality, while such cables must comply with the standards so indicated."

The 44-Hour Week.—The ballot taken by the Federation of Engineering and Shipbuilding Trades on the question of a 44-hour week without reduction of wages, closed on Saturday. There is believed to be a very large majority in favour of opening negotiations for the introduction of the shorter week by the autumn or winter.—*Times.*

Book Notices.—"Science Abstracts" A and B. Vol. XXII, Part 4. No. 256. London: E. & F. N. Spon. Price 1s. 6d. each post free.

"Electrical Development" and "Town Planning." Reconstruction problems Nos. 24 and 25, of the Ministry of Reconstruction series of Grey pamphlets. London: H.M. Stationery Office. Price 2d. each.

"General Plan of the Water-Power Survey of the Japanese Government." (Translated.) Tokyo: Bureau of Electrical Exploitation, Department of Communications.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 5. May, 1919. New York: The Institute. Price $1.

"Book-keeping and Cost Accounting for Factories," By W. Kent. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

Trade Announcements.—Messrs. Wood & Cairns, Ltd., have removed their Glasgow branch to more commodious premises at 65, Waterloo Street. Telephone No.: Central 1465.

Mr. R. G. Cooper, A.M.I.E.E., for many years district engineer to the General Electric Co., Ltd. (South Wales branch), is leaving to join Mr. C. King, of 37, Westgate Street, Cardiff, as electrical and mechanical engineers' and manufacturers' agents (Cooper and King).

Messrs. Thacker, Bell & Co., Ltd., announce that Mr. R. S. Thacker has resigned from the directorate; this will in no wise affect their general business as electrical, mechanical, and machine-tool engineers, merchants and exporters.

The Electrical Alloy Co. notify that they will handle all export business from their general offices and mills, Morristown, New Jersey, U.S.A.

Mr. Harry A. Miller has commenced business as an electrical engineer at 16, Dumbarton Road, Stirling.

Restoration of Pre-War Practices.—The text of the new "Restoration of Pre-War Practices (No. 3) Bill" is now published. The Bill was read a first time in the House of Commons on Monday. It will be found in the *Times* for May 27th. This is the third form in which the Bill has been drawn up, and it is now an agreed measure embodying, it is understood, a settlement arrived at between the Government, the employers, and the Unions.

According to the *Daily Telegraph*, the measure is a very simple one. "It simply decrees the complete and unqualified restoration of these pre-war privileges two months after the signing of Peace, and if, after the lapse of a week, the privileges have not been restored, the workman can institute legal proceedings against the employer. The Bill does away with the notice to the employer to restore, with the majority vote, and with all the other small provisions which were made in the first Bill. It is now understood to be entirely satisfactory to both the men and the employers, and should be passed before Whitsuntide."

Trade Associations and Combinations.—The Committee on Trusts which was appointed in February, 1918, by the Minister of Reconstruction, to consider what action, if any, might be necessary to safeguard the public interest in view of the probable extension of trade organisations and combinations, has now issued its report (Cd. 9236, 6d., H.M. Stationery Office). It contains a great deal of instructive information and a number of conclusions and recommendations, to which we may refer later. The secretary (Mr. John Hilton, of the Garton Foundation) made a separate "Study of Trade Organisations and Combinations in the United Kingdom" for the purposes of the Committee, and this is published together with the general report, as well as notes on "The Law Relating to Combinations," prepared by Sir John Macdonell. Mr. Percy Ashley has contributed to the proceedings a Memorandum on Industrial Combinations

Liquidations and Dissolutions.—Vactite Wire Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. L. J. Yeoman, who is authorised to enter into an agreement for the sale and transfer to the new company. Meeting of creditors June 5th, at 20, Copthall Avenue, London, E.C.

Consolidated Diesel Engine Manufacturers, Ltd.—Meeting called for June 3rd, at Winchester House, Old Broad Street, E.C., to hear a report from the liquidator and to declare a second return to the contributories.

Asbestos Manufactures Co., Ltd.—Meeting June 27th, at 36, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. W. C. Tyler.

Dussek Bitumen Co., Sherman Street, Bromley-by-Bow.—Messrs. A. E. H. Dussek and A. S. Dussek have dissolved partnership. Debts will be attended to by Mr. A. E. H. Dussek, who will continue the business.

Bankruptcy Proceedings.—W. J. McCombe, tramway manager, Kingston-upon-Hull.—Trustee appointed May 24th. Mr. W. G. Hall, Union and Smith's Bank Chambers, Silver Street, Hull.

I.M.E.A. and Electrical Imports.—The Incorporated Municipal Electrical Association has circularised its members under date May 22nd, asking them to furnish this week for the use of the Director of the Board of Trade Department of Import Restrictions, information as to instruments, apparatus, or plant that it is desired should be imported between now and the end of September, 1919. Particulars stating requirements as concisely as possible have to be sent to Mr. T. Roles, Electricity Department, Town Hall, Bradford.

French and Belgian Industrial Reconstruction.—America proposes to supply £15,000,000 worth of machine tools to France and Belgium for re-equipment of factories.—*Times*

The Overseas Trade Committee.—In the House of Commons, last Monday, in reply to a member who asked who were the members of the Committee appointed to determine the relations between the Consular and Diplomatic Services and the Department of Overseas Trade, and what were their terms of reference, Mr. Cecil Harmsworth stated that the Committee appointed by the War Cabinet had the following terms of reference:—"To examine the question of Government machinery for dealing with trade and commerce." The members of the Committee are Viscount Cave (chairman), Sir Horace C. Munro, K.C.B., Mr. F. Dudley Docker, C.B., and Mr. Kenneth Lee.

Non-Ferrous Metals Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for May 27th.

The Mineral Deposits of Spitzbergen.—From the Northern Exploration Co., Ltd., of 62, London Wall, E.C. 2, we have received a brochure entitled "The Gate to the Northern Markets of Europe," in which the coal, iron, and other mineral resources of Spitzbergen are very fully described. The company owns claims extending over about 2,000 sq. miles, containing, it is stated, by far the richest mineral deposits in Western Spitzbergen. It is claimed that the only way in which the Northern European markets can be regained by Great Britain is by the rapid development of these deposits. A 16-page inset shows examples of the many varieties of marble of which there are large deposits available on Marble Island.

LIGHTING AND POWER NOTES.

Australia.—Newcastle.—The T.C. has arranged for a loan of £20,000 from the Commonwealth Bank of Australia for extensions to the electricity undertaking.

Tasmania.—The Government is negotiating with the Mount Lyell Co. with the view of providing Zeehan with electricity from Lake Margaret station. The company will probably install a transmission line to Zeehan, and subsequently continue it to Rosebery. This proposal takes the place of the Government's King River hydro-electric scheme.

Ballynahinch (Co. Down).—Street Lighting.—Application has been made to the L.G.B. for permission to light the streets with electricity. A considerable number of the shops and private houses have been wired in anticipation.

Bray (Co. Wicklow).—Loan.—The U.D.C. has accepted the offer of the Hibernian Bank of a loan of £5,300, at 4½ per cent., to be repaid in 15 or 20 years, for the improvement of the electricity undertaking.

Bury.—Year's Working.—The Electricity Committee reports a loss of £1,983 on the working of the undertaking for the past year.

Price Increase.—The electricity charges are to be increased by a further 30 per cent.

Clacton-on-Sea.—Power Charges.—The Chamber of Commerce has asked the U.D.C. to reduce the power charges for electricity, in order to attract industries to the town.

Continental.—Austria.—The Vice-Chancellor, last week, defined the Government's socialisation plan as including the socialisation of the coal, electricity, wood, and iron industries, thereby giving the State control over the two greatest power sources and the two most important raw materials.

Thus, in spite of its present financial position, the Government seems to be prepared to plunge into a programme costing milliards of crowns. The *Neue Freie Presse*, recognising that the scheme is inopportune, declares that it cannot be fully realised for a generation owing to the debts of the State and of local bodies.

Sweden.—The electro-steel industry of Sweden continues to develop rapidly. According to the *Stockholms Dagblad*, one of the largest ironworks companies—the Domnarfvets Järnwerk—has decided to make considerable additions to its plant. Two new blast furnaces are to be erected, and, what is more suggestive of progress, six electric furnaces for Thomas iron, and two 15 to 20-ton electric-steel furnaces, as well as several Martin furnaces, are to be added to the existing plant.

Cranbrook (Kent).—Extension of Supply.—The R.D.C. is in favour of Hastings T.C. extending its area of supply of electricity to the district. The proposal also includes Rye and Tenterden districts.

Darlington.—Year's Working.—The accounts for the year ended March 31st, 1918, shows that the electricity undertaking has a capital of £152,719 and a revenue of £40,806, which yielded a gross profit equal to 11·81 per cent. on the capital employed. One-third of the debt has been paid off, and in addition to the provision for redemption of the debt there are reserves for depreciation, &c., amounting to £20,484. A sum of £7,535 has been expended out of profits on capital works.

Dewsbury.—Price Revision.—From the meter readings in June next the price of energy for power, heating, lighting, and on the rateable-value system, will be increased by another 10 per cent.

Doncaster.—Loan Application.—The T.C. has applied to the L.G.B. for permission to borrow £40,000 for additional plant at the electricity works.

Elland.—Year's Working.—The report on the past year's working of the Council's electricity works shows a loss of £2,600.

Epsom.—The U.D.C. has informed its consulting engineer, Mr. J. H. Rider, that there is no objection to his ascertaining what offer would be made by the South Metropolitan Electric Tramways and Lighting Co., Ltd., for the Council's electricity undertaking.

Falkirk.—E.P.E.A. Award.—The Corporation has been requested by the E.P.E.A. to grant to the electrical engineer the increases given by the terms of the award.

Faversham.—Price Increase.—The T.C. has given notice that as from July 1st next the price of electricity for lighting will be increased to 7d. per unit.

Greenlaw.—Hydro-Electric Scheme.—The Special Lighting District Committee has informed the Berwickshire C.C. that it proposes to utilise the water-power from the River Blackadder for E.L. purposes, and to request that the necessary powers be obtained from the B. of T.

Grimsby.—New Plant.—The Public Lighting Committee recommends the accepting of the tender of the Stirling Boiler Co. for the supply of boiler house plant, for the sum of £18,648, and directing that an offer of £7,500 be made for the "Russian turbine" and alternator, subject to the plant being satisfactory to the Borough electrical engineer; and that, if such offer is accepted, the British Westinghouse Co.'s tender to supply new condensing plant, overhaul and test the turbine and alternator and deliver and erect the whole plant (the Corporation providing rough labour and cartage from the railway to the works) for the sum of £6,125, be accepted.

Hereford.—E.L. Scheme.—At a conference of urban and rural D.C.'s of Herefordshire, held on May 22nd, the Mayor (Councillor E. R. Dymond) explained the Corporation scheme for supplying electricity for power and lighting to areas which might be extended to any distance, but which at present were proposed to be 12 to 20 miles from the city. Already applications had been received from various neighbourhoods within five miles. He explained how the Corporation came to acquire the electric plant, through the Government requiring it for a munition factory. The city, of course, had no power to force the scheme on the District Councils, and before proceeding they wished to learn if those Councils would be prepared to entertain it. Four years would be granted in which to decide, and it rested with them whether the scheme received encouragement or not. There was not a single dissentient to the scheme.

Heston and Isleworth.—Year's Working.—The accounts for the year ending March 31st, shows that the income of the electricity undertaking was £18,647, against £15,434 for the previous year. The sale of energy produced £17,019, and from public lighting £1,368, and from meter rents £255, were received. The expenditure was £18,211, against £14,021 for the previous year. Generation of electricity cost £10,416, and distribution £525. The management expenses were £1,175, the loan charges £4,922, and there was an outlay of £238 on mains and services. The surplus was £436, compared with £7,413 for 1917.

Bulk Supply.—The station engineer reported that it would be necessary to provide for a total prospective demand for 1,421 kw. As the capacity of generators at the station was 1,250 kw., it was necessary to consider what course to adopt. The U.D.C. decided to invite the Twickenham and Teddington Electric Supply Co. to supply in bulk on the basis that the Council would take 400,000 units per annum as a minimum for three years at £4 per kw. of maximum demand, and 0·9d. per unit supplied, plus 10 per cent. per annum on the cost of laying the feeder cable. The price per unit was based on coal at 25s. per ton, and subject to a sliding scale in respect of the cost of coal and labour.

Huddersfield.—Wages.—The unskilled men employed by the electricity undertaking, demanding a 47 hours' week and overtime on all work done in excess of those hours since January 1st, have handed in notice to cease work on May 31st. The skilled men's hours were reduced to 47 on January 1st. The Corporation has replied that it cannot grant the demand. At the time of writing the men are acting without their Federation's sanction.

Hull.—The Electricity and Tramways Committees has held a joint meeting to discuss the amalgamation of the generating stations. It is proposed to close down the tramway power station in Osborne Street, and to depend entirely for lighting and power purposes upon the Soulcoates station. It was agreed that the chairmen and vice-chairmen of each Committee, with the engineers, report upon the question.

Liverpool.—Price Revision.—From June 30th the charges for electricity for lighting, power, and other purposes, are to be increased by a further 25 per cent., a total war increase of 65 per cent. In cases where the rates are subject to adjustment according to the variations in the price of fuel, the post-war advance of 15 per cent. is to be increased by another 10 per cent.

London.—Shoreditch.—The regulation requiring consumers to pay for new services laid has now been withdrawn, and from May 23rd all services which have been approved by the Electricity Committee will be laid free of charge, providing they are within 60 ft. from any of the Council's distributing mains.

St. Pancras.—The E.C. recommends that from the June meter readings the present addition of 2½ per cent. be increased to 25 per cent. for energy supplied for power and heating purposes, and to 50 per cent. for energy supplied for all other purposes. The proposed revision will mean that the pre-war rates will be increased by 75 per cent. for power and heating supplies and 50 per cent. for all other purposes.

Bulk Supply.—An agreement has been come to between the County of London Electric Supply Co. and the City of London Electric Lighting Co., under which fresh generating plant is to be installed at the generating station of the City Co., and bulk supply from this plant will be taken by the County of London Co. The agreement has been approved by the Board of Trade, and the work is proceeding.

Newcastle-upon-Tyne.—Electricity Supply Bill.—A conference of representatives of northern municipalities was held in Newcastle-upon-Tyne, on May 23rd, further to consider the Government's Electricity Supply Bill. Objection was taken to the clause which gives power to District Commissioners to lease their powers for the generation of electricity to companies, and the meeting, being of opinion that there is not a sufficient guarantee in the Bill for securing public control, approved of alterations to be submitted to Parliament in favour of absolute public control.

New Zealand.—Water Power.—The Dominion Government proposes starting forthwith the preliminary work at Mangahao in connection with the North Island hydro-electric scheme. There are to be sub-stations at Otaki, Wellington, Featherston, Masterton, Bunnythorpe, Marton, and Dannevirke. Of the 160,000 h.p. required for the North Island, Mangahao will provide 24,000 h.p. The scheme will provide the City of Wellington with power, in addition to the whole of the province.

Christchurch T.C. has decided to raise a loan of £150,000 for the extension of the electric lighting and power scheme and the installation of stand-by plant to obviate the trouble caused last winter when snowstorms brought down the Lake Coleridge transmission lines.

Nigeria.—Tin Mines Electrification.—The Bauchi Tin Mines, Northern Nigeria, are installing hydro-electric power plant to generate 1,500 h.p., to be transmitted 12 miles to the central point of the property. The cost per unit is estimated at 0·6d., against 2·6d. for oil or coal generation; a saving of £40,000 per annum in fuel is estimated. The total cost of the installation is estimated at £85,000.

Oldham.—Proposed New Plant.—A L.G.B. inquiry was held last week into the Corporation's application for permission to borrow £150,000 for the provision of additional plant at the electricity undertaking. The deputy town clerk stated that he wished to have the application increased by £50,000 for mains and transformers, although the additional application had not been sent to the Board, and would not come before the Council until June. The extensions when complete would allow the ordinary day load to be increased to 1,200 kw. with the present amount of standing plant. The proposed new plant would take a nominal day load of 18,000 kw., with the proper amount of stand-by plant. The day load of 18,000 kw. would be taken up by the winter of 1920. The present capacity was 6,000, with a peak load of 12,160 kw. Mr. Blackmore pointed out that machinery had been ready in the cotton mills to be run by electricity; but the cotton trade being controlled it was not allowed to run, and consequently the Corporation took on additional customers. Directly the cotton trade was in a position to do so, additional load from the mills would be demanded of about 3,600 kw. The outstanding loans of the department amounted to £5,790, and during the past four years the Corporation had spent out of revenue to bring the undertaking up to date £36,277. No neighbouring towns could supply Oldham with power. The application was unopposed.

Plymouth.—Year's Working.—There is a deficiency of £2,190 on the past year's working of the Corporation's electricity undertaking. It will be met out of the reserve fund.

Portumna (Galway).—E.L. Scheme.—A company has been formed to start an E.L. scheme with a capital of £4,000 in 4,000 shares of £1 each. A substantial number of shares are already taken up.

Stalybridge.—Electricity Supply Bill.—At a meeting of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board last week, exception was taken to the Government Bill now before Parliament, and the matter is to be taken up with local members of Parliament.

Taunton.—Proposed Price Increase.—The T.C. has decided to apply to the B. of T. for powers to increase the maximum price of electricity, the limit under the Order having been reached by the recent advance to 75 per cent. over the pre-war rates.

Uruguay.—A company to supply electricity at Azul, Province of Buenos Ayres has been formed at that town. The initial capital will be $400,00 m/n., of which one-fifth has already been subscribed.

United States.—ATLANTIC COAST POWER SUPPLY.—An article in the *Electrical World* gives an account of the views of W. S. Murray at a meeting of the A.I.E.E. on the plan of the Secretary for the Interior for the power supply of the thickly populated industrial district between Washington and Boston. Mr. Murray considers that the annual waste of power in this area through uneconomical production amounts to as much as 50 to 100 million dollars' worth, and in general he is heartily in accord with Secretary Lane's proposals. These include the electrification of all railways in this part of America, the inauguration of the trunk line system of transmission between Boston and Washington, not too near the coast for military reasons, and consisting of steel transmission towers carrying wires bearing three-phase, 25-cycle current at a pressure probably of 150,000 volts, the transmission lines being three or four in number and lying parallel to each other in private ground. There should be large unit tide-water steam-electric stations, hydro-electric stations and steam-electric stations at coal mining centres, the last-mentioned of which should produce a KW.-hour for an expenditure of 10 to 15 lb. of steam. The millions of tons of culm coal now wasting would thus be made available. The fuel consumption ratio between electric locomotives and steam locomotives is 2 to 1 in passenger service, 2½ to 1 in freight haulage service, and 3 to 1 in switching. In industrial factories electric driving will effect a fuel saving in the ratio of 2 to 1. Prof. Breckenridge estimates that coal production has increased by five times in the last few years and that the available supply of anthracite will be exhausted in 75 years. A map which is included in the article shows the chief centres of power concentration in this area, and gives the electrical capacity at present installed in Boston as 450,000 KW.; Worcester, 50,000; Western Massachusetts, 150,000; Providence, 175,000; Albany, 135,000; New Haven, 150,000; New York City, 1,000,000; New Jersey, 250,000; Philadelphia, 400,000; Harrisburg, 125,000; Baltimore, 110,000; and Washington, 100,000 KW.

Walsall.—HOURS OF WORK.—The institution of a 48-hours' week in the case of shift-engineers, and a 47-hours' week in the case of day workers, together with a stoppage of overtime, has necessitated increasing the regular staff by seven men, representing approximately £1,220 per annum.

Windsor.—MAINS EXTENSION.—The R.D.C. has given consent to the Windsor Electrical Installation Co., Ltd., laying a main to supply energy to premises at Clewer.

TRAMWAY AND RAILWAY NOTES.

Colne.—YEAR'S WORKING.—The actual loss on the tramways, last year, was £3,139. At the electrical works there was a loss of £576.

Continental.—GERMANY.—The Cologne tramway employés struck work on Saturday, leaving the cars standing in the streets. They asked for increased pay of 4s. per day: the employers offered 3s., but the leaders of the agitation were not supported by the bulk of the men. The men then went to work as usual, but resolved to take no money for fares, whereupon the authorities cut off the electricity supply and prevented the cars running. At this stage the British military authorities stepped in, and the trouble was settled by midday.

BELGIUM.—Antwerp tramway employés were expected to resume work on May 26th. Their dispute with the tramway company is being submitted to arbitration.

Huddersfield.—YEAR'S WORKING.—For the year ending March 31st last, the capital outlay to date on the Corporation tramways was £477,507. The income was £199,411, the mileage being 2,461,387, compared with £174,292 received in the previous year on 2,784,039 miles run. The working expenses were £140,514, against £117,490 in the previous year. There was a gross surplus of £58,897. The reserve and renewals account was £79,000. The number of passengers carried was 30,946,790, as against 22,616,710 in 1914.

Isle of Man.—FARE INCREASE.—The Isle of Man Legislature last week authorised the Douglas Corporation to advance the fares on its tramway system by 50 per cent. There has been a loss on the working of the tramways during the war of over £12,000.

Jamaica.—RAILWAY ELECTRIFICATION.—With reference to our note under this heading the week before last, it is said that the local agent of the Westinghouse Co. of New York is collecting data on which the company may tender for laying down the electric railroad.

London.—Traffic receipts of three of the London tramway companies during the last 12 months show the following increases:—South Metropolitan, £14,000; M.E.T., £84,802; L.U.T., £7,954. In most cases the greater portion of the increased revenue has been absorbed in higher working costs. At the meeting of the L.U.T. Co. last week, it was stated that the expenses had gone up £81,970, leaving the company with an adverse balance of £11,040 on the year's working. The company's Act had received the royal assent. Its powers authorise an extension of the company's tenure of the tramways in Middlesex and Surrey until the year 1950; six months after the termination of the war the fares may be increased to a maximum of 1d. per mile for ordinary passengers and three miles for a penny for workmen.

STRIKE.—The L.U.T. Co. states that a portion of the system was affected on Friday last by a strike at Chiswick and Hounslow depôts, called by certain motor-men refusing to drive with a non-Union conductor. The men were instructed by their Union to return to work.

Clapham and Stockwell underground stations on the City and South London Railway are to have escalators.

TRAFFIC CONGESTION.—Sir Auckland Geddes, as acting President of the B. of T., received a deputation of London M.P.'s on Friday last, who urged the establishment of a Select Committee to deal with overcrowding and high fares. Sir A. Geddes, in a long reply, said the war had brought about a different distribution of working people during the day, and a consequent disturbance of communications. By moving Government departments from the centre of London to places like Alexandra Park, it was hoped to relieve the congested area considerably. There was no difficulty, he contended, in obtaining import licences for materials and spare parts required for repairs to rolling stock. Traffic concerns and the manufacturers could "get anything they want if they take the trouble to get it." There was a shortage of seasoned timber, but excellent substitutes were available, and he considered that the best policy was to concentrate on repairs at present, rather than build new vehicles. Sir A. Geddes next defended the increased fares. Those within the 12-mile limit were within the statutory maximum charges, and the B. of T. had thus no power to interfere. The London United Tramways Co. had been permitted to increase its fares because its financial position was so bad that it was in the hands of a receiver. Other tramway increases were within the statutory maxima. The tubes were not under the control of the Railway Executive Committee. They had 60 new cars on order before the war, and specifications were being prepared for another 100. Not a single car had been ordered since the armistice. As to the proposed Select Committee, he would do nothing to resist its appointment if it were pressed for, but he did not feel that it was going to help very much. The problem was too big to be tackled by a House of Commons Committee which did not consist of experts, and in any case the whole question of traffic was going to be handled by the Ministry of Ways and Communications. Eventually the deputation agreed to meet Sir Auckland again at a later date.

Manchester.—TRAFFIC CONGESTION.—Replying to criticisms as to the congested tramway traffic, Councillor Chapman informed the T.C. last week that the Tramways Committee was hoping to provide 100 additional tramcars this year, each of which would cost £2,000, as against £800 before the war.

Mansfield.—EXTENSION.—The Light Railway Commissioners have granted the Mansfield and District Light Railway Co. an Order to extend the system to Rainworth and Clipstone, and to increase fares on an average by 50 per cent.

New Zealand.—AUCKLAND.—The T.C. has accepted a three months' option of the purchase, subject to the confirmation of the ratepayers, of the electric tramways. The price is £1,140,250, with the current year's profits.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Exclusive wireless telegraphy is a Government monopoly in Australia, as a result of the war, and it is unlikely that the Cabinet will revert to pre-war conditions in this regard. There seems little likelihood of the proposal before the Government from a private company, for the erection of a high-power station at Sydney to dispatch and receive messages direct from England, being accepted; it may be taken that wireless will continue a Government monopoly in the same way as the telephone and telegraphs of Australia. It is probable that the scheme to erect a Government station powerful enough to speak direct with England will come up for early Cabinet consideration. It is interesting to learn that the Fremantle and other Australian stations were able, during the war, to intercept messages from Nauen, in Germany, 12,000 miles away. These were the official communications sent out by the German Government.

Another matter to which attention will shortly be given by the Government for the development of the inland portions of Australia is wireless telephony. Successful experiments have been made already by the Royal Australian Radio Service, which demonstrate the commercial value of wireless telephony.

Czecho-Slovakia.—A powerful wireless station has been set up at Belgrade, the ancient capital of Serbia, by the French military authorities. The height of Bianitza, to the east of the city, is the spot chosen for its erection.

Germany.—It is calculated in Germany that an expenditure of over £5,000,000 has been incurred in establishing the German system of submarine cables. The Treaty of Peace stipulates that in the name of her nationals Germany renounces in favour of the Allies certain cables as specified by us last month. It appears that the European terminal sections of both trans-Atlantic cables, of the cable to Vigo, Spain, and the South American cable are left in the hands of Germany. This is also the case with the German Government cable to Norway, and the "various cables in the North Sea and the Baltic." The cables from Shanghai to Yap, and from

Menado to Yap, belong to the German-Netherlands Telegraph Co., which is a purely German private concern, whilst the other cables, with one exception, are the property of private companies. On the other hand, the Shanghai-Tsingtau cable is owned by the German Government, and was worked by State officials. The German cable companies were in receipt of a Government guarantee on their dividends up to a certain percentage, and their cables would have passed into the possession of the Government, free of charge, at the end of 40 years from the date of completion for service. The obligation was placed upon the companies to form a special redemption fund, so that on the expiration of the 40 years the amount available would have been sufficient to pay all debts and redeem the shares at par.

Telegraphic Delays.—According to a *Times* correspondent, messages from Madrid transmitted over Marconi's system were nine and ten days in transit, reaching London several days after letters confirming them.

United States.—The Federal Director of Cables, New York, is issuing daily for the Press a bulletin on the condition of cable service to countries with which Americans principally do business.

President Wilson, in a message to Congress, which met on May 19th, recommends that the control of telegraphs, cables, and telephones be returned to the owners.

A wireless telephone message was received at New Brunswick, N.J., in a closed concrete and steel vault underground. The speech was plainly heard.

Wireless on Ships.—The Bill introduced in the House of Lords recently by Lord Somerleyton to make further provision with respect to wireless telegraphy on ships, provides that every seagoing British ship registered in the United Kingdom, being a passenger steamer or a ship of 1,600 tons gross tonnage or upwards, shall be provided with a wireless telegraph installation, and shall maintain a service at least sufficient to comply with rules which are to be made, and shall be provided with one or more certified operators and watchers. The Board of Trade may exempt any ships, and, in consultation with the Postmaster-General, shall, it is suggested, make rules prescribing the nature of the installation to be provided, of the services to be maintained, and the number of operators and watchers to be carried. Failure to comply with these provisions renders the master or owner of the ship liable to a fine of £500.—*The Times.*

Wireless Telephony.—On Tuesday and Wednesday demonstrations of wireless telephony and direction-finding were given by Marconi's Wireless Telegraph Co. at the works at Chelmsford. Particulars will be given in our next issue.

Wireless Telegraphy.—Speaking on the progress of wireless telegraphy and telephony at the Aldwych Club on Thursday last week, Mr. Godfrey C. Isaacs is reported to have said that there was now a better development than the wireless direction finder. There was a new transmitter which would project a wide divergent beam. The beam would extend over whatever area was required, and, if desired, would indicate some special place. It would have concentrated beams—one, two, or more—which would convey to the man in the skies automatically and intermittently the name of the place he was passing over.

When a number of wireless stations were in close proximity there was considerable interference, which made an efficient service impossible. But that was a thing of the past; in future it would be possible to telephone or telegraph without any possibility of interference. There was now no reason why there should not be wireless telegraph and telephone services between all the principal centres throughout the country. If such services were constructed as auxiliaries to the land-lines, they would render the country a great service and save many millions sterling, particularly in times of storms.

The latest and best station that had been erected was one at Carnarvon, which, although it had been erected to conduct a service with New York, had never yet given that service; it had been engaged for war purposes. He hoped that within a very short time it would be open to commercial service.

There was no doubt that sooner or later they would have an Imperial chain of wireless stations for commercial purposes. The cost of such stations was moderate, cost of maintenance small, and capacity for traffic practically unlimited. Wireless could do 150 words per minute simplex and 300 duplex. It would require but a very simple mechanical improvement to double or quadruple that number of words.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—U.D.C. Supplying and laying of cable. (See this issue.)

Atherton.—June 10th. U.D.C. 2,360 yd. ·1 × ·1 × ·141 in. twin-concentric, paper-insulated and plain lead-sheathed cable. (See this issue.)

Australia.—BRISBANE.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.). Offices of the company at Brisbane.—*Tenders.*

SYDNEY.—June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Ballinasloe.—June 7th. *Renewal of electric accumulator plant at District Asylum for Joint Committee of Management. Particulars from Resident Medical Superintendent.

Bray.—June 3rd. U.D.C. Electricity Department. One 200-B.H.P. Diesel engine, direct coupled to 135-K.V.A. single-phase alternator and exciter. (May 23rd.)

Bury.—June 6th. Electricity Department. One 6,000-KW. steam turbo-alternator and exciter, with surface condenser and air circulating pumps. (May 16th.)

Dublin.—June 10th. Electric Supply Committee. Transformers and A.C. slot meters for two years. (See this issue.)

Eccles.—June 23rd. Electricity Committee. Supply and laying of three-way underground ducts; supply and drawing-in 2,733 yd. of ·20 sq. in., E.H.T., three-core cable. (See this issue.)

Heywood.—June 11th. Electricity Committee. One 400-KW. rotary converter, transformer, with switchgear and cable work; 1,500 yd. ·15 sq. in. E.H.T. cable; 1,500 yd. ·05 sq. in. E.H.T. cable; 1,000 yd. of ·10 sq. in., ·05 sq. in., and ·10 sq. in. E.H.T. cable. (May 23rd.)

Hull.—Corporation Telephones Committee. Automatic equipment to provide for an increase of 2,000 instruments.

Ilford.—U.D.C. Electricity Department. Supply of 350 yd. L.T. rubber-insulated, and 75 yd. E.H.T., 3-core, paper-insulated, lead-covered cable. (See this issue.)

Loftus.—June 6th. U.D.C. Electric motor, 2, 3 or 4 B.H.P., complete with starter, &c. Mr. B. J. Wormleighton, Surveyor, Town Hall. Loftus.

Manchester.—June 6th. Stores for Electricity Committee for six months. Particulars, obtainable not later than May 30th, from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

June 10th. Tramways Committee. Supply, &c., of (*a*) 2 and 3-ton motor engines and chassis; (*b*) light motor vans suitable for parcels delivery; (*c*) motor car. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middleton.—June 12th. Electricity Committee. One 1,000-KW. motor converter. (See this issue.)

New Zealand.—June 4th. Public Works Department. 1½ miles of 11,000-volt cable.*

Rhondda.—June 4th. U.D.C. Four 500-K.V.A. and two 100-K.V.A. three-phase static transformers. Mr. J. M. Bowman, Electrical Engineer, Electricity Works, Porth (Glam.).

Tasmania.—LAUNCESTON.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

Tuam.—June 3rd. Tuam Electric Light & Power Co., Ltd. Gas engine and suction plants, dynamos, storage battery, switchboard. (See this issue.)

Warrington.—June 4th. Electricity Department. H.T. and L.T. lead-covered cable, motors and transformers. (See this issue.)

West Hartlepool.—June 17th. Corporation. H.T. switchgear; two 1,500-KW. transformers; two 500-KW. rotary converters; one cooling tower. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Government Contracts.—The undermentioned contracts were placed during April, 1919:—

INDIA OFFICE—STORES DEPARTMENT.

Accumulators.—Edison Accumulators, Ltd.
Dynamos.—J. Stone & Co.
Motor construction.—Bruce Peebles & Co.
Tape.—Johnson & Phillips, Ltd.
Telephones.—Peel-Conner Telephone Works Co., Ltd.
Wheatstone parts.—Elliott Bros., Ltd.
Cells.—Edison Accumulators, Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric light fittings.—General Electric Co., Ltd.
Insulators.—Bullers, Ltd.
Superheater spares.—Superheater Corporation, Ltd.
Train lighting materials.—J. Stone & Co., Ltd.
Wiring materials.—W. T. Henley's Telegraph Works Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering works.—Electric overhead runway, Leslie Flax Mill.—Herbert Morris, Ltd.

POST OFFICE—STORES DEPARTMENT.

Telegraph apparatus.—D. Murray.
Telephone ditto.—British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Stoneware ducts and bends.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; H. R. Mansfield; Mountford, Phillips & Co., Ltd.; Oates & Green, Ltd.; Stanley Bros., Ltd.; Sutton & Co.; T. Wragg & Sons, Ltd.
Insulator spindles.—Guest, Keen & Nettlefolds, Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Laying conduits.—Cheltenham, W. Hodge & Co.; Coatbridge-Airdrie, Casey and Darragh; Crickiewood Lane, Doulton & Co., Ltd.; Glasgow-Contbridge (Sec. II), Casey & Darragh; Glasgow-Dumbarton (Sec. I), Robson, Eckford & Co., Ltd.; Glasgow-Dumbarton (Sec. II), Casey and Darragh, Ltd.; Motherwell-Wishaw, W. Dobson; Ormskirk-Preston (Sec. I), Jowett Bros.; Ormskirk-Preston (Sec. II), W. Dobson; Edinburgh (Sec. III), W. Dobson; Edinburgh (Sec. IV), J. Mowlem & Co., Ltd.; Rawtenstall-Bacup, W. Pollitt & Co., Ltd.; Slough-Windsor, J. Mowlem & Co., Ltd.; Willesden, J. Mowlem & Co., Ltd.
Manufacturing, supplying, and drawing-in and jointing cables.—Liverpool-Chester, Johnson & Phillips, Ltd.; Manchester-Bolton, W. T. Henley's Telegraph Works Co., Ltd.
Laying conduits, and manufacturing, supplying, drawing-in and jointing cables in P.O. engineering districts, as below, for six months from April 1st, 1919.—Scotland, N. & N.E.: Siemens Bros & Co., Ltd. N.W. and S. Lancashire: Callender's Cable & Construction Co., Ltd. N.W.a, S.W.a, and N.M.: Western Electric Co., Ltd. S.W., S.M.E., and S.E., and London (cabling only): Western Electric Co., Ltd.

Melbourne.—City Council. Recommended :—

16 tons bare H.D. copper cables, assorted gauges, £2,273.—B. I. & Helsby Cables, L'd.

Murrumburrah (N.S.W.).—B.C. Accepted :—

Alternator, transformer, switchboard, meters, lightning arresters, and erection of power-house plant, £1,137.—Australian General Electric Co.
10-KW. transformers, insulators, cables, &c., £435.—W. G. Watson & Co., Ltd.
—*Tenders.*

Richmond-on-Thames.— T.C. :—

Electric dust van.—General Vehicle Co., Ltd., £1,295.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 30th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Resumed discussion on "The Mechanical Properties of Steel, with some Consideration of the question of Brittleness."

Illuminating Engineering Society.—Friday, May 30th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Discussion on "The Gas-filled Lamp and its Effect on Illuminating Engineering," to be opened by Mr. F. W. Willcox.

London County Council.—Friday, May 30th. At 4 p.m. At the County Hall, Spring Gardens, S.W. Conference on "The Report of the Committee Appointed to Inquire into the Position of Natural Science in the Educational System of Great Britain."

Institution of Electrical Engineers.—Monday, June 2nd. At 7.30 p.m. At the Chartered Institute of Patent Agents, Staple Inn Buildings, Holborn, W.C. Informal meeting. Discussion on "The Vicious Circle of Increasing Prices," to be opened by Major K. Edgcumbe, R.E.

Society of Engineers.—Monday, June 2nd. At 5.30 p.m. At Burlington House, W. (Apartments of the Geological Society). Informal meeting. Features include lantern lecture by Mr. A. S. Buckle on "His Visit to France as a Member of the Commission Appointed by the Ministry of Labour for the Resettlement of Officers in Civil Life."

Industrial Reconstruction Council.—Tuesday, June 3rd. At 6 p.m. At the Institute of Journalists, Tudor Street. E.C. Conference on "Co-partnership in Industry," to be opened by Mr. E. H. Mundy, Secretary of the Labour Co-partnership Association.

Roentgen Society.—Tuesday, June 3rd. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Annual general meeting.

Royal Institution of Great Britain.—Tuesday, June 3rd. At 3 p.m. At Albemarle Street, W. Tyndall lecture on "Listening Under Water," by Prof. W. H. Bragg.

Friday, June 6th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Atomic Projectiles and their Collisions with Light Atoms," by Sir E. Rutherford, F.R.S.

British Engineers' Association.—Tuesday, June 3rd. At 11.45 a.m. At Connaught Rooms. Annual general meeting, to be followed by a luncheon at 1.15 p.m.

Industrial Administration.—Special series of lectures, by Mr. E. T. Elbourne. At Winchester House, Old Broad Street, E.C.
Wednesday, June 4th. "Factory Organisation." (Lecture I.)
Thursday, June 5th. "Labour Administration." (Lecture I.)
Friday, June 6th. "Factory Costing." (Lecture I.)

NOTES.

Pre-war and Present Prices of Electrical Energy.—Central-station managers who have not yet sent us particulars of their tariffs in 1914 and 1919 are requested to do so as quickly as possible, the matter being now in the press.

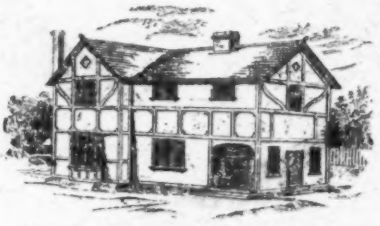
The Abortive Strike.—According to the *Daily Dispatch*, the Electrical Trades Union has not yet settled the trouble within its organisation arising from the unofficial strikes at Belfast, the Clyde, and London, for which strike pay was granted. It has been declared by ballot of the rank and file that the executive were wrong in so disbursing the funds, and the question now remains what action the Executive Council will take in view of this decision. One of them, Mr. Stavenhagen, of the London district, has already, it is stated, tendered his resignation.

Electricity at the Royal Agricultural Show, Cardiff.—For patriotic reasons and for propaganda work in the agricultural world, as well as amongst the general public, the Cardiff City Electricity Department and the South Wales Electrical Power Co., in close co-operation, are arranging an exhibit of labour-saving devices at the forthcoming Royal Agricultural Show, to be held in Cardiff from Tuesday, 24th, to Saturday, June 28th next. A Committee, consisting of Messrs. W. A. Chamen (engineer and general manager, South Wales Electrical Power Co.); C. T. Allan (assistant manager, S.W.E.P. Co.); Arthur Ellis (Cardiff City electrical engineer and manager); C. G. Morley New (deputy electrical engineer and manager); and R. Howard Fletcher, B.A. (consulting engineer, Cardiff), has been formed to put the idea in operation, and has taken plot No. 300A in the Show ground, in an excellent position, close to the Main Ring, and near the Royal Pavilion.

Three-phase and single-phase 50-cycle supply will be transformed from 6 600 volts to 400 and 230 volts and transmitted to the exhibit by a low-pressure temporary overhead line about a mile long. This line passes the Moving Machinery Exhibit, where electricity will be on tap for those exhibitors who desire it.

On the plot will be erected a pretty little building as shown below, of which the interior will contain a kitchen, dining room, and showroom, suitably furnished and fitted. As many domestic labour-saving appliances as can be discovered will be shown, to enable the house-wife to see that much of the drudgery and the monotony of domestic work can be eliminated and some of it made pleasurable.

The Americans, for several reasons, appear to be more advanced than we in the use of these small appliances, as one can see by the advertisements in their trade and other papers, also their manufacture does not seem to have been restricted by the war; but, naturally, the Committee desires to have British-made devices. It is, however, experiencing some difficulty in finding the names of the firms who specialise in this work. The main reason for this difficulty is that the British maker during the war ceased the manufacture of home comforts and patriotically turned his whole staff and works on to finishing the war by the making of munitions. Since he has finally "wound up the watch on the Rhine," he has not yet had time to resume his former business.



THE ELECTRIC MODEL HOME, CARDIFF.

In order to help to the best of its ability, the Committee asks the British makers of domestic labour-saving-appliances to send their catalogues to Mr. C. T. Allan, Royal Chambers, Queen Street, Cardiff, so that if their machines cannot yet be shown, they can have publicity.

The number of visitors to the Show from all over this country and from abroad is expected to be a record. Lady visitors are urged to come, to see and enjoy Stand No. 300A.

Industrial Essay Competition.—*Unity*, the organ of the National Alliance of Employers and Employed, offers prizes amounting to £200 (presented by Sir Robt. Hadfield, Bart.) for the best essay on either of the following subjects :—A practical scheme for the joint development of industry by Capital and Labour.

The most effective means for the prevention of unemployment.

The most effective means for the prevention of industrial disputes.

Particulars may be had from the Editor, *Unity*, 64, Victoria Street, London, S.W. 1. The competition closes on August 30th, 1919.

Electricity in German Mining Industry.—Numerous new electrical installations for mining purposes have been made during the war. The three-phase double commutator motor has become less favoured for haulage plant. Ilgner haulage motors have shown great advantages for moderate outputs, with provision for cutting the converter (without fly-wheel) out of circuit after each haul, in order to save light-running losses. For outputs of several thousand KW., the induction motor is coming into increasing use. For mine locomotives, the D.C. system has been found to be preferable, both from the point of view of economy and safety of the workers. A considerable number of new electrical installations have been made during the war in the oilfields of Roumania, Galicia, and Germany. Many electrical devices for mining have been developed to meet the needs of the war, such as portable pumps and tunnelling plant. These will probably continue to find use in mining after the war. Electric generating stations have been built in many cases near coal mines for cheap generation and distribution. Notwithstanding the large scale of these stations the cost of generation has not decreased, owing to the increased cost of steam production, which may be taken at present at Mk.4 per ton of steam, or double the cost before the war.—*E.T.Z.*

Electrical Golf.—Representatives of Edinburgh and Glasgow Corporation Electricity Departments' Golf Clubs played the annual golf match (after an interval of four years) over Lothianburn golf course on "Victoria Day," 20th inst.; it resulted as follows:—Edinburgh, 4; Glasgow, 7.

Electric Vehicles.—According to the Electric Vehicle Section of the National Electric Light Association, on January 1st, 1919, approximately 10 per cent. of all automotive street vehicle equipment in New York City was of the electric type. These figures do not include several hundred electric industrial trucks and tractors in use. It will be of interest to note that of the 3,288 electric trucks in use in the metropolitan district, 3,055 are over two years old, 1,492 over six years old, 179 over ten years old, and 23 over 15 years old. It is said that the fact can be established by actual figures that during the first ten years' operation of an electric vehicle it can be kept in service 280 days out of a possible 300 per year, and eliminating painting or serious accidents, 295 days out of a possible 300.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The next informal meeting will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., on Monday, June 2nd, 1919, at 7.30 p.m., when Major Kenelm Edgcumbe, R.E., will open a discussion on "The Vicious Circle of Increasing Prices."

The report of the Committee of the Students' Section for the Session 1918-19 states that during the session there have been eight general meetings and the annual general meeting; the average attendance at these meetings has been 45, the highest recorded being 108. The opening address to the Section was delivered by Prof. Ernest Wilson on November 22nd, 1918, the subject being "The Permeability of Faintly-Magnetic Materials," and at the remaining meetings seven papers and lectures were delivered.

At the meeting of March 18th Mr. Howgrave-Graham showed an interesting exhibition of ancient and modern illuminants, including the first types of incandescent electric lamps.

By the kind consent of the respective authorities, visits have been made during the session to the following works, the average attendance at these being 31:—Osram-Robertson Lamp Co., Hammersmith; Victoria Telephone Exchange, Westminster; Marconi's Wireless Telegraph Co., Ltd., and Hoffmann Manufacturing Co., Ltd., Chelmsford; Western Electric Co., Ltd., North Woolwich; Siemens Bros. & Co., Ltd., Woolwich; L.B. & S.C. Railway, electrification system.

Further visits have been arranged as follows:—

June 13th, 1919.—Handley-Page, Ltd., Cricklewood.

June 28th, 1919.—National Physical Laboratory, Teddington.

July 8th, 1919.—Anglo-Swedish Electric Welding Co., Ltd., Greenwich; London Electric Supply Corporation, Ltd., Greenwich.

An informal dinner is being arranged for June 6th, 1919.

The Papers Committee of the Council is examining all the Students' papers held over since the award of Students' premiums was suspended, with a view to making awards at an early date.

As a practical means of obtaining a closer link between the Council and the Section, arrangements have been completed during the session, for:—

(*a*) The appointment of a representative of Council as a consultative member of the Students' Committee, and

(*b*) The appointment of a representative of the Students' Committee to be present at those meetings of the Council at which business of special importance to Students is under consideration.

By means of this link, several suggestions for the welfare of the Students' Section have been placed before the Council, some of which have already materialised.

The report shows a considerable improvement in the activities of the Section during the Session 1918-19, and upon the completion of the return of Students to their normal occupations after their duties in connection with the war, and with the aid of the various improvements in the operation of the Students' Section which have been recently introduced, it is hoped that its activities will be still further increased in the near future.

The annual meeting of the Students' Section of the North-Eastern Centre was held in Newcastle-on-Tyne on May 21st, Mr. A. P. Pyne, local president, in the chair. Mr. J. Rosen, the hon. secretary, submitted the annual report, which stated that the membership of the Section totalled 39, as against 30 last session. It was reported that a "live" Committee had been formed, that instructive papers had been prepared for next session, and that visits to the works of prominent firms in the district had been arranged.

Electricity Supply in East Anglia.—A public meeting was held at Beccles on May 14th, to consider the subject of "Electricity: A National Need," having special application to Beccles. The subject was fully explained by Messrs. F. M. Long (Norwich) and Napier Prentice (Stowmarket).

Mr. Napier Prentice referred to the early history of electricity supply in England, and pointed to the progress made in other countries. He referred to Dr. Ferranti's address as president of the I.E.E. in 1907, in which he demonstrated that with proper utilisation of our coal resources, electricity could be developed in large power stations and transmitted throughout the country at one-eighth of a penny per unit, the by-products from the proper utilisation of coal enabling us by intensive cultivation to have our own food supply independent of outside sources and the unnecessary waste by the hauling of large quantities of coal. Mr. Prentice showed what a benefit this would have been to this country during the war if the railways had been free to carry the goods urgently needed by the military authorities, and what assistance such a supply would have been in the manufacture of munitions. He called attention to the Coal Conservation Sub-Committee's report, and touched upon the report of the Board of Trade Committee on "Electrical Power Supply," commenting on the fact that no reference was made to the purchase of gas undertakings in districts in which district electricity boards might operate. His view was that it would be much cheaper for the country to buy out gas interests rather than to have any delay in the prompt carrying out of a national electric supply scheme; and further, it would be unfair that electricity supply, financed nationally, should be in competition with private or municipally-owned gas works. He was glad to say that his directors had adopted that view, and had called the attention of the Board of Trade to the matter. He reminded them that East Anglia was admirably suited for industrial development, given cheap power, and that it was in the national interest so to develop this part of the country. He (Mr. Prentice) had been authorised by his directors to inaugurate a supply in Beccles. It was only part of a much bigger scheme, and he appealed for support in carrying through the work.

Mr. Long explained the object of the national scheme. He strongly advised the people of Beccles to assist the company both by taking a supply of electricity and by giving facilities for the necessary overhead wires.

In the discussion which followed, Mr. A. McQueen (the chairman) said that there was no reason why people who wanted electricity should not have it at once. He hoped it would come to Beccles by next winter.

Provincial Electric Supply Committee.—Mr. H. B. Renwick, chairman of the Provincial Electric Supply Committee of the United Kingdom, presided on Tuesday at the Holborn Restaurant at the annual meeting of the 120 statutory companies represented in the Association.

Mr. Renwick reported on the vast amount of work done by the Committee in the past year, especially in connection with Parliamentary matters, income-tax allowances, and Labour matters. With regard to the Electricity Supply Bill (which came under special discussion at the meeting), Mr. Renwick said that the year 1919 was likely to become one of the most momentous in the history of the industry. They were on the threshold of far-reaching changes—fraught with good or evil, not only to the industry, but even more, perhaps, to the trade of the country. The industry was now admitted by Parliament to be a key industry, and they were told it was the one industry on which they were to build up the future prosperity of the country, and to rescue the trade of the nation from possible bankruptcy. He dealt with the various points in the Bill where the companies were unfairly treated, and assured the Committee that on all such points amendments would be pressed for. Whatever ground there might be for the nationalisation of the railways, there was no ground whatever for the nationalisation of electric supply. But he raised no objection to official control so long as that control was on proper lines for the purpose of regulating, co-ordinating, and re-organising the industry.

Society of Technical Engineers.—The fifth general meeting of the present session of the Bristol and West of England District Branch was held at the Grand Hotel, Bristol, on the 22nd inst. Mr. H. R. Beasant, vice-chairman (in the unavoidable absence of the chairman, Mr. W. P. Wordsworth), presided over one of the largest attendances since the formation of the Society in the West. After the routine business of the Society had been transacted, a paper, entitled "Aero Engines," was read by Mr. A. H. R. Fedden, technical director to the Cosmos Engineering Co., Ltd.

Appointments Vacant.—Telegraph inspectors (£250 + £120), for the Nigerian Posts and Telegraph Department; assistant electrical engineer (£300 + £120), for the Gold Coast Government Railway Department; chief assistant (£350), for the Kettering U.D.C. Electricity Department; lecturer in the Electrotechnic Department (£240, rising to £400, plus war bonus), for the Borough Polytechnic Institute; meter tester (£252), for the Sunderland Corporation Electricity Department; general manager (£800), for the Hull Corporation Tramways. See our advertisement pages to-day.

Old Students' Dinner.—University College, London.—The annual dinner of the Engineering Society will be held at the Holborn Restaurant on June 20th, 1919. It is hoped to have a large gathering of old students, especially those who have been serving in His Majesty's Forces, to celebrate the Peace.

Old students of the Faculty are asked to communicate with Mr. J. A. Broughall, at Gower Street, if they wish to be present.

American Welding Society.—Welding has attained to such importance in the engineering world that an American society is to be formed to secure its efficiency and promote its extension. The scope of this society will include all branches of the industry, and it will create and assist in maintaining a bureau of welding, which will be a separate organisation designed to derive full advantage from the principle of co-operation in research and standardisation. A temporary organisation, with headquarters at New York, has issued an invitation to all interested in welding to become members of the society, in which will be merged the Welding Committee of the Emergency Fleet Corporation and the National Welding Council.

The Apprenticeship and Skilled Employment Association. The thirteenth annual report of this Association draws attention to the difficulty of inducing lads who have been earning high wages during the war to accept lower wages, while there is a dearth of vacancies under the present unsettled conditions. Interest in apprenticeship schemes has revived, though the war has shown that in many trades skilled craftsmanship is not so necessary as formerly. The report regrets that no definite statement can be obtained as to when the scheme of State assistance for demobilised soldier apprentices will become operative. The finances of the Association are in need of support.

In 1918, 412 boys and 258 girls were placed in situations, and, in all, 1,504 cases were dealt with. Total receipts, including £35 brought forward, were £264.

The Association is doing valuable work, to which our readers can materially contribute both by donations and by applying to it for apprentices when vacancies are available.

Wireless Society for Sheffield.—A wireless society is being formed for Sheffield and the adjoining district. Those desirous of joining are invited to communicate with Mr. L. H. Crowther, 156, Meadow Head, Norton Woodseats, Sheffield.

Inquiries.—Makers of machines for winding small diameter spiral heating resistances are asked for.

The B.A. Meeting at Bournemouth.—The meeting of the British Association for the Advancement of Science opens at Bournemouth on Tuesday, September 9th, with the delivery, in the Winter Gardens, of the address by the president, Sir Charles A. Parsons, K.C.B., who will take as his subject, "Engineering and the War." The proceedings close on Saturday, September 13th. The Reception Room will be at the Municipal College, Lansdowne. The local secretaries' office is Municipal Buildings, Bournemouth. Prof. W. A. Herdman, D.Sc., F.R.S., and Prof. H. H. Turner, D.Sc., F.R.S., are the general secretaries of the Association; and Mr. O. J. R. Howarth is the assistant secretary (Burlington House, London, W.). This will be the first occasion on which the Association has met at Bournemouth, and as it is the first that has been held for several years, owing to war conditions, it is reasonable to anticipate a successful gathering both in point of attendance and in regard to the interest of the subjects for addresses, papers, and discussions. One of the two evening discourses will be delivered in the Winter Gardens on Friday, September 12th, by Mr. Sidney G. Brown, F.R.S., on "The Gyroscopic Compass." Section "A" (Mathematical and Physical Science) will be presided over by Prof. Andrew Gray, F.R.S.; Section "B" (Chemistry), by Prof. P. Phillips Bedson, D.Sc.; Section "F" (Economic Science and Statistics), by Sir Hugh Bell, Bart.; Section "G" (Engineering), by Prof. J. E. Petavel, F.R.S.; Section "L" (Educational Science), by Sir Napier Shaw, F.R.S.; and Section "M" (Agriculture), by Prof. W. Somerville, D.Sc. There are no general excursions to be arranged as part of the Association's programme, but the local executive will furnish information as to places of interest to be visited, and probably some of the Sections will arrange trips on their own.

The Southampton Appointment.—The procedure followed by the Southampton Town Council in appointing a successor to the borough electrical engineer, Mr. H. F. Street, has led to a great deal of discussion in the town and elsewhere. It will be remembered that the post was offered to Mr. H. S. Ellis, of South Shields, without advertising the vacancy. This course immediately aroused fierce opposition, and protests were recorded by the E.T.U. and other Trade Unions in the district, which called for the resignation of the Mayor and other members of the Council. The post was then advertised by the Electricity Committee, after animated discussion in the Council, at a salary of £800 a year, age limit 40 years. Some 42 applications were received, and a short list of three names was selected, comprising Mr. Ellis, Mr. H. P. Stokes (Bexley), and Mr. R. Lomax (Stockport). The Committee interviewed Messrs. Ellis and Stokes; Mr. Lomax had withdrawn his application, and Mr. Stokes, after the interview, wrote saying that, as the decision of the Council was a foregone conclusion, no useful purpose could be served by his presence at an interview with the Council. Protests were lodged by the Trades and Labour Council and the Joint Engineering Societies of Southampton, the latter condemning the methods of the Electricity Department, and the wording of the advertisement, and expressing high appreciation of the valuable services which had been rendered by Mr. Street. The employés of the electricity department also entered a protest, signed by 141 out of 142, against the "irregular and questionable tactics adopted," which had brought the town into disrepute, and had led to the undertaking being "boycotted by all electrical engineers of standing"; the staff held that the age limit was obviously fixed to favour one applicant, and expressed a lack of confidence in the committee, which was called upon to resign forthwith, the position to be readvertised. The copy of the protest sent to the Council was signed by Mr. A. Glew.

At the Council meeting last week it was stated that the Labour member had withdrawn from the Committee in disgust. The report of the Committee recommended that Mr. Stokes and Mr. Ellis should be invited to attend before the Council, but also recommended that Mr. Ellis be appointed. The Mayor said there was no question of favouritism; Mr. Ellis was chosen on his merits. After a lively discussion Mr. Ellis was appointed by a majority of 29 to 9. In thanking the Council, Mr. Ellis expressed strong resentment at the action of the staff, and stated that he was going to be manager, not they.

We are indebted to the *Southampton Times* for these particulars.

Parliamentary.—Liverpool Corporation is making application to the Light Railway Commissioners for authority to purchase and incorporate in the tramway undertaking the Liverpool and Prescot Light Railway.

Shropshire, Worcestershire, and Staffordshire Electric Power Co. is applying to Parliament for power to raise further capital, &c.

Electricity on the Farm.—Cows are milked by electricity at Hereford. With motive power supplied by an 8·5 H.P. motor about seventy cows are milked twice daily at one dairy, and it is stated that it would take at least five expert milkers to do the work in the same time. A system of light transmission lines has been erected at Hereford, radiating in five directions from the generating station in the centre of the city to a maximum distance at present of 3,400 yards. The poles are erected close into the hedges. In an average case a 10-H.P. motor will meet most of the requirements of a farm, but for such seasonal jobs as thrashing and cider milling motors up to 20 H.P. have been hired out. Root-pulping and chaff-cutting machines are installed, and experience shows that owing to the easy starting of an electric motor the exact quantity of food can be cut and mixed fresh as required, a very important result being a greater yield of cream in the milk. A machine for kibbling corn and rolling oats is also installed, as well as a circular saw. The farm buildings are electrically lighted throughout, and, in addition, some cottages are supplied off the same line through "penny-in-the-slot" meters.

The Westinghouse Mass Meeting.—At the Free Trade Hall, Manchester, on the evening of May 19th, between 3,000 and 4,000 Westinghouse workers of all grades foregathered on common ground with the management and directors, first and foremost to discuss problems of mutual interest and create and absorb a better feeling of confidence, and secondly, to enjoy a musical programme of Westinghouse talent throughout. The meeting was an unqualified success. Capt. H. S. Hilton, managing director of the company, presided, and in his opening remarks pointed out that such a function was the first of its kind in the country. The meeting was an outcome of a suggestion by the Works Committee, and there had been a most gratifying response. It was hoped that it would become an annual function.

Mr. J. Annan Bryce, chairman of the company, spoke of the setting-up of works committees as a sign of the recognition of that human relationship between employers and employed which was going to be the only source of happiness for the country. The experience of the company showed that there was a real desire on the part of the workers to co-operate through the Committee in endeavouring to remove grievances, in assisting in necessary disciplinary measures, in settling holidays and the arrangement of holiday work, and in finding out how men's individual capacities could be best employed. Mr. Bryce put increased production per man as the only means of overcoming the difficulties British industry had now to face—heavy taxation and a handicapped export trade. He described as a fallacy the old idea that there was only a certain amount of work to go round, and that if a man did more he would deprive others of work. The real effect, he said, was that the more a man did the more work there was for other people, the cheaper the article he produced became, and the greater was the demand for it. The argument that because an article was sold cheaper the employer would want to pay less wages was equally wrong, for if the employer could sell more he could afford to pay more. The worker was entitled to higher wages and to shorter hours, and to opportunity for recreation and enjoyment. If he would produce more, and would welcome the adoption of every kind of improved method of machine production, it would be possible not only to pay him more, but to raise his standard of life.

Mr. S. Ratcliffe, chairman of the Works Committee, urged the need for frequent meetings between the workers and the management, where the problems of the industry could be discussed. Those at the head of the Labour movement had considerable difficulty in asking for the loyalty of their members in securing increased production, because that had so often meant just before the war that factories had been choked with goods, and men had been unemployed because they had made too many goods. If that fear could be overcome, and the worker could be sure that his interests were safeguarded, they would get the increased production which was so necessary for the repair of the waste of war.

Mr. W. Rostron, chairman of the Staff Committee, held that in studying the profit and loss account the human element should be taken into consideration as well as the material. Miss Wilson, Women's Welfare Superintendent, voiced the women's point of view. She remarked upon the necessity of every job being "manned" by the proper person: if strength was required, by the man; if it was work which could be done more efficiently by women, then women should do it. Mr. Mensforth, general works manager, remarked that it was an excellent thing to eliminate the differences and get together first the points of agreement.

Capt. Hilton announced that the original allotment of £100,000 worth of shares to be taken up by workers of the company had been over-subscribed. After a musical programme of 10 items had been gone through very satisfactorily, Col. Cradock, director of the company, moved a vote of thanks to the artistes, and the meeting closed.

Industry and Higher Education.—A meeting was held on May 20th between representatives of the Universities and Colleges and representatives of the Federation of British Industries.

Sir Richard Vassar-Smith, Bart., presided over the gathering, and, in his introductory remarks, stated that the meeting had been called to consider the setting up of an organisation which might act as a clearing-house between the universities and the industries of the country. It was desired to make some arrangements by which young men leaving the universities would have the opportunity of passing into productive work, which would give full scope to their abilities and education. Such an organisation should enable the man of real merit to obtain a post which would allow him to use his abilities to the fullest extent.

Mr. H. A. Roberts, of Cambridge University, stated that the suggestion would meet with approval by all interested in national well-being.

Prof. Ferrier, of Bristol University, pointed out that there had been no difficulties in placing the really first-class men, but men of the second class certainly needed assistance. In many cases the second-class men had made good, when they had been able to obtain a position which offered scope; ability was not confined to academic distinction—especially was this the case with regard to work in industry and commerce. There had been a marked tendency for the university-trained men to proceed overseas, and even in the United States the English University man was generally sure of finding employment. It was to be hoped that this exodus of the finer grade of worker would be stopped by the offer of suitable employment in this country.

It was decided that a further meeting should be held to thrash out practical points for the setting-up of the scheme at an early date. The meeting was attended by representatives of the Universities of Birmingham, Bristol, Cambridge, Durham, Glasgow, London, Manchester, Oxford, Sheffield, Wales, and the Imperial College of Technology, and the University College of Nottingham.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—The General Purposes Committee of the L.C.C. recommends that for a period of one year, commencing January 1st, 1919, the electrical engineer, and the traffic manager of the Council's tramway department be granted a 10 per cent. addition to their salaries, plus a war bonus of £80 a year, with a maximum increased payment of £300 a year, to be paid in the same manner as in the case of officers in receipt of £800 and over.

Mr. E. L. Pope, distribution engineer, southern section of the L.C.C. tramway department, is retiring from the service owing to ill-health.

Major G. C. Milnes, K.O. Royal Lancaster Regiment, who has been on special service since the Armistice, will be released for his duties as electrical engineer at Lancaster on June 27th, and hopes to return soon after that date.

The Leeds Corporation Tramways Committee has decided to recommend the Council to increase the salary of Mr. J. B. Hamilton, the tramway manager, from £1,000 to £1,500 per year. As Mr. Hamilton has been officiating as the commercial manager to the Corporation at an additional £500 a year, the combined salary, if the recommendation be confirmed, will be £2,000 per year.

Lieut. H. H. Holmes has now been demobilised, and has resigned his position as sales manager of the St. Marylebone electricity department.

On the next degree day, July 5th, 1919, the degree of M.Sc.Tech. (*honoris causa*) is to be conferred by the University of Manchester upon Mr. S. L. Pearce, O.B.E., city electrical engineer; Mr. A. P. M. Fleming, O.B.E., head of research department, British Westinghouse Co., Ltd.; and Mr. H. C. Mensforth, O.B.E., works manager, British Westinghouse Co.

Mr. W. P. Lilwall, assistant engineer, Kettering U.D.C. electricity works, has been appointed electrical engineer and manager of the Fleetwood U.D.C.'s undertaking. There were 147 applicants for the position.

Mr. C. R. Everson, manager of the Plymouth Corporation tramway, is shortly retiring on superannuation. The Tramways Committee has decided to advertise for a successor.

Notwithstanding the controversy with which our readers are familiar, Mr. H. S. Ellis, borough electrical engineer at South Shields, has been appointed to a similar position at Southampton at £800 per annum. Mr. Ellis is the son of the late Sir Joseph Baxter Ellis, first Lord Mayor of Newcastle-upon-Tyne. During the war he acted as technical representative of the Controller of Coal Mines for No. 3 Area.

The Electricity Committee of the Heston and Isleworth U.D.C. recently received a letter from Messrs. Gordon and Marley, solicitors, acknowledging receipt of the notice to terminate his appointment as electrical engineer and manager addressed to Mr. P. E. Rycroft, and stating that the matter had been placed in their hands, and that as soon as they had perused the correspondence they would write further.

Mr. F. W. Purse, city electrical engineer, Carlisle, has been appointed borough electrical engineer to the West Ham Corporation in succession to Mr. J. W. Beauchamp, Director of Electrical Development.

General.—The King has granted permission to the following to wear decorations conferred upon them by the King of the Belgians:—*Officers of the Order of Leopold*: Temp. Maj.-Gen. Sir H. W. Thornton, K.B.E., general manager of the G.E.Ry.; Sir R. Bruce, C.B., Controller of the London Postal Service. *Chevaliers of the same Order*: G. Morgan, I.S.O., Controller, P.O. Stores Dept.; Sir W. Slingo, Engineer-in-Chief, G.P.O. (now retired); P. Dawson. *Officer of the Order of the Crown*: J. Newlands, C.I.E., C.B.E., Controller of the Central Telegraph Office; W. Noble, Assistant Engineer-in-Chief (now Engineer-in-Chief) of the G.P.O.

Mr. W. N. Y. King, A.C.G.I., A.M.I.E.E., formerly Assistant Inspector of Munitions Areas (Birmingham), is now assistant works engineer to the Austin Motor Co., Ltd., Northfield, Birmingham.

Mr. K. S. Geipel, O.B.E., who has been demobilised from the Royal Engineers after service in France and East Africa, has returned to Messrs. Wm. Geipel & Co.

Mr. E. Laming, shift engineer with the Rochdale Corporation, has been appointed to a similar position with Messrs. John Brown & Co., Ltd., of Sheffield.

Marconi's Wireless Telegraph Co., Ltd., announces that Sir Charles J. Stewart, K.B.E. (the late Public Trustee), has been elected to a seat on the board of the company.

A letter from Sir John Snell was read at a special meeting of the Belfast Corporation last week. Sir John, who has been consultant in connection with the electrical scheme which the Corporation has in hand, intimated that the Government had asked him to accept the position of Chief Electricity Commissioner and Chairman of the Commission under the Electricity (Supply) Bill, and he asked the Corporation if they would release him from his personal contract with them in event of the measure becoming law. A long discussion followed a resolution by Ald. Sir James Johnston to release Sir John, seconded by Ald. Riddell. The Town Solicitor said that beyond doubt the contract was with Sir John Snell, not with his firm, and he had bound himself to carry out all the necessary details, supervise the work, and prepare all plans and specifications that were necessary in connection with the work. However, in his opinion, the Corporation was competent to release Sir John on proper terms. It was decided to release Sir John from his contract and any liability to the Corporation.

Sir Albert Stanley, M.P., has now resigned the presidency of the Board of Trade, owing to the necessity of his taking a complete rest at once. Sir Auckland Geddes, K.C.B., M.P., has been appointed to the office that Sir Albert, who has been seriously ill of late, has felt compelled to relinquish.

Mr. Phillip Vassar Hunter, for many years chief electrical engineer to Messrs. Merz & McLellan, of Newcastle-on-Tyne and London, is leaving that firm to join the management staff of Messrs. Callender's Cable & Construction Co., Ltd. Mr. Hunter has been connected with the development of electrical power on the North-East Coast since its very beginning, and has had wide experience of high-tension generation and transmission there and elsewhere. During the later stages of the war Mr. Hunter was, by arrangement with Messrs. Merz and McLellan, attached to the Naval Staff of the Admiralty as Engineering Adviser to the Director of the Anti-Submarine Division in connection with the development of anti-submarine devices and apparatus. He has been recently released from Admiralty service, and becomes a member of Callender's as from June 1st specially for the development of super-tension mains and accessories.

The Industrial Reconstruction Council is arranging a complimentary dinner to be given to the Rt. Hon. J. H. Whitley, M.P., by members of the Joint Standing Industrial Councils and the Interim Industrial Reconstruction Committees. It will be held at the Connaught Rooms at 7.15 p.m. on Wednesday, July 9th.

Roll of Honour.—Sapper A. W. Wells, R.E., who was on the staff at the Windsor electric light works, is reported dead, after being missing since August 21st last.

Obituary.—Prof. Fedoroff Mirovitch.—According to the *Times*, a wireless message from Moscow reports the death of the mining engineer Prof. Fedoroff Mirovitch, renowned for his scientific work in crystallography.

NEW COMPANIES REGISTERED.

Norfolk Engineering Co., Ltd. (155,326).—Private company. Registered May 20th. Capital, £500 in £1 shares. Electrical and mechanical engineers, and manufacturers of kinematograph projectors. The subscribers (each with one share) are:—R. W. Hickman, 67, City Road, Sheffield, electrician; P. A. J. Norton, 390, Cricket Inn Road, Sheffield, engineer. The first directors are: R. W. Hickman and P. A. J. Norton. Registered office: 239, Bernard Street, Sheffield.

Turbines, Ltd. (155,393).—Registered May 22nd. Capital, £20,000 in 10,000 shares of £1 each and 100,000 shares of 2s. each. Engineers, &c. First directors:—F. B. Woodruff, 222, Kew Road, S.W., shipbroker; D. Brown, 5, Talbot Road, South Tottenham, shipbroker; H. Vale, Park Place, S.W., gentleman; W. Boorman, 5, Masons Avenue, E.C.2, gentleman; B. K. Parkin, 137a, Finchley Road, N.W.3, consulting engineer; A. P. Whitehead, 190, Haworth Road, Hounslow, director, Middlesex Engineering Co.; D. Scarf, 8, Spencer Gardens, East Sheen, S.W.14, bank clerk. Registered office: 39, St. Mary Axe, E.C.

Vickers-Petters, Ltd. (155,436).—This company has been registered as a private company, with a nominal capital of £500,000 in £1 shares (180,000 6 per cent. cum. pref. and 320,000 ord.). The objects are: To take over certain property and rights on the terms of two draft agreements (1) with Vickers, Ltd., and (2) with Petters, Ltd., and to carry on the business of engineers, contractors, iron and metal founders, launch and shipbuilders, metal workers, smiths, iron and steel converters, shipowners, wharfingers, &c. The subscribers (each with one share) are:—E. W. Petters, Ltd., 75, Queen Victoria Street, E.C., engineer; E. J. Alldis, 18, Macdonald Road, Forest Gate, E. 7, clerk. There are to be not less than five nor more than seven directors. When there are five directors, three are to be nominated by Vickers, Ltd., and two by Petters, Ltd., and when there are seven four are to be nominated by Vickers, Ltd., and three by Petters, Ltd. No qualification is required. Remuneration as fixed by the company. Solicitors: Linklater & Co., 2, Bond Court, Walbrook, E.C.

Cannon Motor & Electric Works, Ltd. (155,293).—Private company. Registered May 20th. Capital, £1,000 in £1 shares. To acquire the business of motor car or electrical repairers, dealers, in motor vehicles, &c., recently carried on by A. Jay and M. J. Wallage, and now solely by M. J. Wallage, at 10-12, Cannon Lane, Brighton, as the Cannon Motor Works. First directors:—A. W. Turner, 50, Preston Street, Brighton; and M. J. Wallage, 1, Devonshire Terrace, Brighton. Registered office: 46, Old Steine, Brighton.

Thurlow Wholesale Electric Supplies, Ltd. (155,317).—Private company. Registered May 20th. Capital, £5,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are:—K. N. Herbert, 337a, Norwood Road, S.E. 27, electrical engineer; Miss M. F. Aylward, 37, Hamilton Road, West Norwood, clerk; W. Osborne, 16, Maley Avenue, West Norwood, S.E. 27, electrician; L. A. Fenner, 13, Heyford Avenue, South Lambeth Road, S.W. 8, scientific instrument maker. The first directors are: Miss M. F. Aylward and W. Osborne. Registered office: 337, Norwood Road, S.E. 27.

Oxley, Lawrence & Co., Ltd. (155,270).—Private company. Registered May 19th. Capital, £10,000 in £1 shares. Mechanical and electrical engineers, &c. The subscribers (each with one share) are:—H. H. Oxley, 13, King Edward Avenue, Dartford, electrical engineer; G. C. Lawrence, 11, Brentgood Street, Bury St. Edmunds, marine engineer. Directors: H. H. Oxley and G. C. Lawrence. Registered office: 60-61, Blackfriars Road, S.E. 1.

Wm. J. Ferguson (Redditch), Ltd. (155,252).—Private company. Registered May 17th. Capital, £1,000 in £1 shares (500 pref.). Electrical and mechanical engineers, &c. Agreement with W. J. Ferguson. The subscribers are:—W. J. Ferguson, 144, Mount Pleasant, Redditch, electrical engineer, 150 shares; J. A. Mills, Crown Hotel, Redditch, licensed victualler, 100 shares; M. Hardman, Ewart Cottage, Millsboro' Road, Redditch, captain, 200 shares. Directors: W. F. Ferguson, J. A. Mills, M. Hardman. Registered office: 15, Market Place, Redditch, Worcester.

C.L.I. Manufacturing Co., Ltd. (155,159).—Private company. Registered May 15th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrical apparatus and machinery. The subscribers (each with one share) are:—G. A. Lister, 82, Styvechale Avenue, Coventry, engineer; W. S. Tunbridge, 116, Colmore Row, Birmingham, solicitor. Directors: G. A. Lister and C. A. Lister, Sneyd Park, Bristol, manufacturers; D. K. Morris, 14, Waverley Road, Kenilworth, electrical engineer; E. A. Watson, 14, Bottecille Road, Acocks Green, electrical engineer; E. W. Richmond, The Firs, Dursley, Glos., engineer. Registered office: 116, Colmore Row, Birmingham.

Saunders Electrical Co., Ltd. (155,209).—Private company. Registered May 16th. Capital, £2,000 in £1 shares. Manufacturers and repairers of and dealers in electrical appliances and apparatus, &c. The subscribers (each with one share) are:—W. M. Lindley, Vilette, Binley, Coventry; H. L. Wilson, The Furlongs, Ryton-on-Dunsmore, both law clerks. The directors are to be appointed by the subscribers. Solicitors: R. A. Rotherham & Co., Coventry.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—£250 debs. registered May 7th, 1919, part of series of £10,000, charged on general assets.

Frank Wigglesworth & Co., Ltd.—£5,000 debs. registered May 2nd, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Bankfoot Power Co., Ltd.—Satisfaction to the extent of £5,000 of charge for £10,000, registered August, 1911.

Renew Electric Lamp Co., Ltd.—Debs. registered May 12th, 1919, for £500, £250, and £1,000, part of a series of £4,000.

City of Buenos Aires Tramways Co., Ltd. (82,214).—Capital, £1,240,000 in 248,000 shares of £5 each. Return dated March 3rd, 1919. All shares issued; £1,240,000 paid. Mortgages and charges: £170,000.

Waste Heat & Gas Electrical Generating Stations, Ltd. (91,738).—Capital, £350,000 in £1 shares. Return dated April 14th, 1919. 320,000 shares taken up; £320,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Oriental Telephone and Electric Co., Ltd.

For the year ended December 31st last the gross earnings, including dividends and interest from subsidiary companies, &c., were £100,320; with excess profits duty refunded and amount brought forward the total amount was £119,133. The working expenses, maintenance, &c., were £55,720, and after paying interest expenses incurred in connection with increase of capital issue and bonus shares, and redemption charges, paying the preference dividend also, a total dividend of 10 per cent., free of tax, on the ordinary shares, £7,587 is placed to reserve, £2,000 to staff pensions fund, and £11,052 carried forward.

The business of the company continues to extend, notwithstanding the continuance of the adverse circumstances created by the war. The Government embargo on the supply of telephone material, both here and in India, and the difficulties of shipment have in particular proved a serious obstacle to the expansion of the service during the year. In consequence of these restrictions there is a considerable waiting list of new subscribers at each of the branches of the company and its subsidiaries; and expenditure in connection with new stations and other deferred work is likely to be heavy for some time to come. The rates of subscriptions at Madras, Rangoon, and Moulmein have been slightly raised in order to counter-balance to some extent the abnormal cost of maintenance and working.

In accordance with the special resolutions confirmed at an extraordinary general meeting held on July 15th, 1918, the authorised capital of the company was increased to £400,000 by the creation of a further 100,000 new ordinary shares of £1 each, and a clause (84a) was added to the Articles of Association under the heading "Capitalisation of Profits and Distribution of Surplus Capital Assets." By a resolution passed the same day, a sum of £107,587, forming part of the company's reserve fund, was capitalised and applied to paying in full for 107,587 ordinary shares which were allotted to the shareholders in proportion to their holdings.

As notified in last year's report, the Government of Egypt purchased the undertaking of the Telephone Co. of Egypt, Ltd., as from January 1st, 1918. The liquidation of that company is now proceeding, and, it is hoped, will be finally completed at an early date. In accordance with Clause 84a of the Articles of Association, the company in general meeting on November 25th, 1918, resolved that the sum of £1 6s. per ordinary share (being part of the surplus capital assets of the company, consequent upon the sale of the Egyptian undertaking) be distributed as capital amongst the ordinary shareholders, and the distribution was accordingly made.

The Indian local companies continue to show increased revenues for the past year, and dividends have been declared by both of them at the same rates as for 1917, viz., 16 per cent. by the Bombay Telephone Co., Ltd., and 7 per cent. by the Bengal Telephone Co., Ltd.

The net revenue of the China and Japan Telephone & Electric Co., Ltd., is somewhat less than that of the previous year, in consequence of heavier charges for maintenance, &c., the high rate of exchange ruling, and additional taxation in the United Kingdom. The usual rate of dividend, viz., 10 per cent., free of income-tax, has, however, been maintained.

British Electric Transformer Co., Ltd.

Mr. Berry, presiding at the annual meeting, on May 22nd, said that during the year they had issued the balance of their ordinary and preference shares to the full authorised amount of £200,000. The reserve account stood at £45,722, and it was proposed to increase it by £7,500. The item of sundry creditors was about £10,000 more than last year, the amount naturally increasing with the larger volume of work in hand. They had expended £6,104 during the year on the purchase of freehold land, plant, and machinery. The stock was about £33,500 more. That was naturally a fluctuating item and varied from year to year with the amount of work in hand. Sundry debtors were about £13,000 more, but they were all considered good. Turning to the profit and loss account, the gross profit showed an increase of about £6,000 over last year, and the net profit was over £5,000 more, which was a satisfactory increase. The directors recommended the payment of the usual 6 per cent. on the preference shares. For three years during the war period the dividend on the ordinary shares was reduced to 7½ per cent, and as much cash as possible was put back into the business in order to help them carry on. Last year they were able to revert to their pre-war rate of 10 per cent., which he thought might now be considered a full and sufficient dividend. It was pleasant, by payment of a bonus of 2½ per cent., to afford some special recognition of the rights of the ordinary shareholders, and it was an indication as to what should be hoped for in the way of an ordinary dividend. Owing to the necessary heavy taxation, the community, through the Government, divided dividends with shareholders so that 15 per cent. to-day was scarcely equivalent to 10 per cent. in the past. In view of the extent of the work in hand the directors had obtained the sanction of the Treasury for the issue of 125,000 shares, half ordinary and half preference, bringing up the issued and authorised capital to £325,000. That was by no means all the additional working capital they required. It was so largely over-applied for that they were unable to give larger applicants anything like what they asked for. The small shareholders, however, including the employés, got practically all they applied for. Their greatest difficulty, which was also the case with other specialist firms, was to produce and constantly improve inventions which possessed such outstanding merits that this and other countries could be made to feel the need of them. The shareholders should realise that the strength and capacity for development of such a business as they possessed was greatly enhanced by the extraordinary complexity of their products. There could be no two opinions as to the future demand for their products, and the board would take every opportunity to keep the company so placed as to be of the maximum value to the shareholders, the workers, and the industry. In conclusion, he reminded the shareholders that they could be of great use to the company and themselves by using "Tricity" methods in the home, and he referred to the fact that the directors were having a number of rooms fitted up at "Tricity House," 48-50, Oxford Street, showing applications of electricity in the home, which he said he hoped would be visited by shareholders later on to see for themselves what great domestic help they could reasonably expect from electricity.

Fellows Magneto Co., Ltd.

At the annual meeting, held on 21st inst., Mr. V. L. Fellows, who presided, said that the meeting was being held at the works at Willesden in order to afford shareholders the opportunity of viewing the works, which evidenced the very important and extensive business that had been built up during the war on an original capital of only £66,000. During the year the capital was increased to £114,696. The directors now recommended the payment of a final 5½ per cent.; making 9½ per cent. for the year, on double the original preferred capital, and a dividend of 24 per cent. on the ordinary shares, as compared with 15 per cent. for the 18 months to the end of 1917. Moreover, they had set aside £4,496 for depreciation, &c., and retained a surplus in hand of £3,130. Judging from contracts already in hand, and from business done since December 31st,

they were earning considerable profits, sufficient to cover the expenses due to the change over to peace production, and also to maintain the present dividends, not only on the issued capital, but also on the new capital for the issue of which they would ask approval, in order to provide for the extension of the factory, and for general purposes. In view, however, of the profitable prices ruling for other motor electrical accessories, their manufacture had been undertaken by the company, and in one case a very large contract sufficient to absorb their entire surplus output had already been accepted. The company was therefore no longer dependent solely on one product. Prospects were most encouraging. The demand for their magnetos both in the home, foreign, and Colonial markets was greater than they could at present supply. They had the advantage, moreover, of being safeguarded against undue competition by the Government protection which the magneto industry must continue to receive as a "key industry" of national importance. They had also concluded arrangements of a highly satisfactory nature for the handling of their export trade for the whole world. The directors had decided to recommend the doubling of the present authorised capital by the creation of 50,000 ordinary shares of 10s. each, and 100,000 8 per cent. cumulative participating preferred shares of £1 each. The shareholders would have the prior right of subscribing for the new issue, on favourable terms.

The directors' report states that for the year ended December 31st last, after allowing £4,638 for depreciation and writing down preliminary expenses the available profit is £14,128, as against £8,514 for the previous 18 months, plus £1,182 brought forward, making £15,311. The directors recommend payment of final cumulative dividend of 4 per cent., less tax, together with a participating dividend of 1½ per cent.. less tax, on the preference shares, making 9½ per cent. for the year, and a dividend of 2¼ per cent., less tax, on the ordinary shares, leaving £3,130, which after deducting excess profits tax (if any) it is proposed to place to reserve, less £1,000 to be carried forward. The report states since the armistice large contracts for the supply of magnetos for export and for the home markets have been accepted, and deliveries already made.

French Companies.

The receipts of *The Chemin de Fer Nord-Sud* in 1918 amounted to £621,000, as compared with £601,000 in the previous year. As, however, the working expenses and financial charges increased in a greater proportion the year has closed with a loss of £24,000, as against profits of £22,000 in 1917.

The Compagnie Continentale Edison reports gross profits of £44,000 in 1918, as contrasted with £40,000 in the preceding twelve months, and the net profits were £16,000 and £22,000 in the two years respectively. Including the balance brought forward the amount available for disposal is £27,000, and the directors recommend a dividend of 6 per cent., as against 4 per cent. in 1917.

The report of *The Compagnie Generale de la Telegraphie sans Fil*, presented at the recent meeting held in Paris, states that the gross profits in 1918 amounted to £51,000, and the net profits to £36,000. It was decided to pay a dividend of £1 1s. 6d. per share. The shareholders also sanctioned a proposal to increase the share capital from £500,000 to £1,000,000 so as to provide funds for the development of the company's own business and assist the associated companies.

The receipts of *The Compagnie de Chemin de Fer Metropolitain of Paris* in 1918 amounted to £2,990,000, as compared with £2,855,000 in the preceding year. On the other hand, the working expenses increased from £1,454,000 in 1917 to £1,823,000 last year, whilst the financial charges raise the total charges to £3,122,000. The result is a deficit of £132,000, which, however, is reduced to £82,000 by the appropriation of the balance brought forward from 1917. This unfavourable situation renders it impossible to pay any dividend for 1918, whereas a rate of 5.6 per cent. was distributed in 1917. Negotiations are proceeding, however, between the company and the Paris City Council, and if these are successful they will guarantee the payment of 4 per cent. on the shares for last year.

Shanghai Electric Construction Co., Ltd.—The profit, £71,537, for 1918 compares with £67,504 for 1917. Including £14,264 brought forward the amount is £85,801, out of which £10,000 has been put to reserve for renewals, and £8,000 to extinguish preliminary expenses account. The dividend for the year is 10 per cent. and a bonus of 5 per cent., less income tax, and £19,801 is to be carried forward, subject to excess profits duty. The loss by exchange on subsidiary coinage in 1918 was £39,038, equal to 12.20 per cent. on the capital. The ratio of depreciation to gross takings was somewhat increased during the year, and still shows an unfavourable tendency. The traffic and net receipts for the current year continue to be satisfactory; 15 trailers and 7 railless electric cars will be brought into service as soon as practicable to meet the increasing traffic. There will then be 90 motors, 85 trailers, and 14 railless cars (total 189). Operating expenses show an increase, due to the greater cost of power resulting from the high price of coal, which is likely to continue for the present.

Aster Engineering Co. (1913), Ltd.—Dividend for 1918 10 per cent., free of income-tax, leaving £33,282 (subject to excess profits duty for 1918) to carry forward. At the annual meeting, held in London on May 14th, Mr. R. H. Wheeler, who presided, said that during the war they had manufactured their engines for electric generating sets, searchlights, electric welding, wireless telegraphy, the lighting of aerodromes and camps, &c. They had also produced a number of "Green" engines up to 500 H.P. for coastal motor-boats. Their pioneer work in the development of internal-combustion engines had enabled them to make a substantial contribution toward the national requirements at a critical period. They were in an excellent position for carrying out their post-war programme, and could confidently look forward to a long period of increasing prosperity if the workmen did their part in enabling the firm to compete in the world's markets.

Electric Construction Co., Ltd.—The net profit for the year ended March 31st, 1919, after providing £6,481 for debenture interest and £10,000 for depreciation is £68,680, plus £31,886 brought forward, less excess profits duty paid for year ended March 31st last £28,219. After paying 7 per cent. on the preference shares and a final dividend at the rate of 9 per cent. per annum on the ordinary shares, making 7½ per cent. for the year and a bonus of 2½ per cent. on the ordinary, all under deduction of income tax, £12,263 is transferred to general reserve, leaving £38,669 to be carried forward, subject to liability for excess profits duty. The report states the company having been engaged in electrical work only during the war, no serious dislocation arose after the armistice was signed, but the turnover was affected by the cancellation or postponement of war orders. The volume of business obtained since has been considerably in excess of the capacity of the works at Wolverhampton, and it was accordingly decided to make an important extension which it is hoped will be completed by the autumn. The issue in March last of £75,000 ordinary shares to provide the necessary funds was fully subscribed.

West London & Provincial Electric Supply Co., Ltd.—The annual meeting was held on May 21st. The chairman (Mr. H. Kahn) said the profit and loss account of the West London undertaking showed little change, as the amount received from the Chiswick E.S. Corporation was the same as last year, transfer fees had been slightly less, and sundry expenses £15 more, making the balance profit £3,477, as against £3,494. The total amount with the balance brought forward was £3,539, out of which it was proposed to pay a dividend on the cumulative shares of 6 per cent., less tax, and the interest on arrears for the year 1913 of 4½ per cent. on the funding certificates carrying forward £87. The Chiswick Co. (which also supplied Aberystwyth) showed an increase on the sale of current of £1,010. The total gross revenue was £839 higher than last year, due to higher prices charged, which were not sufficient to offset the higher price of fuel and labour. Cost of generation was £1,117. Purchases of current in bulk had increased by £627, the total expenditure showing an increase of £1,164. As regards 1919, he hoped that they had reached the highest point as regards price of fuel and rates of wages, and believed the coming year would show an improvement, which had already been borne out by the results of the first quarter.

Calcutta Electric Supply Corporation, Ltd.—The report for 1918 shows as follows: Units sold 30,431,132, as against 26,596,827 in 1917. Houses connected 9,897, an increase of 156. Gross revenue £304,955, against £259,397. Net revenue £214,095, against £173,949. The net profit for 1918, plus balance brought forward and interest received, £261,960. £54,279 has been placed to the credit of the depreciation and renewals account. Excess profits duty estimated at £32,000 for 1917-18 is provided for in addition to £15,000 reserved in last year's accounts. £4,000 is put to reserve, £5,000 to the insurance fund, £12,500 to the pension fund, and a final dividend is recommended on the ordinary shares for the second half-year of 6½ per cent., plus bonus of 1 per cent., leaving £56,324 to be carried forward after providing for the directors' additional remuneration of £3,000. Expenditure on capital account last year £30,855. Total outlay to December 31st last £1,398,675. The demand for electrical energy still continues to increase. Units sold to consumers:—

	1919.	1918.
Five weeks ended January 31st ...	2,555,453	2,456,464
Four weeks ended February 28th ...	2,009,647	2,080,083
Four weeks ended March 28th ...	2,379,613	2,440,756

Potteries Electric Traction Co., Ltd.—During 1918 the revenue was £224,139. Traffic and parcels receipts amounted to £206,135, an increase of £46,074. Expenses increased by £28,277. After deducting all expenses chargeable to revenue, including £11,025 for debenture interest and a provision of £10,000 for renewals, there remains £53,561 (plus £8,380 brought forward), as compared with £34,444 for 1917. There is put to reserve account £25,000. A dividend of 5 per cent. per annum on both the preference and ordinary shares is paid, leaving to carry forward £12,441. The gross receipts show considerable expansion as a result of the alterations made in the fares in May last. The company has been approached by the Stoke-on-Trent Corporation for the purchase of the company's undertaking.

Richardsons, Westgarth & Co., Ltd.—The profit for 1918, after providing for estimated liabilities to Government, was £133,275. Two years' preference dividend arrears have been paid, and out of the available balance of £23,817 a further year's dividend is proposed. The directors also propose another year's preference dividend out of current year's profits, thus bringing payments to end of April, 1912.

Babcock & Wilcox, Ltd.—Net profit for 1918, £438,986, plus £77,055 brought forward. After paying the preference dividends and 9 per cent. on the ordinary shares, free of income tax; £150,000 has been placed to reserve fund, £10,000 to the staff pensions fund, and £92,088 remains to be carried forward. The change over from war work to ordinary is proceeding as rapidly as possible. The construction of the works of the Spanish company is proceeding as rapidly as possible. The company has recently acquired from the Government the buildings and some of the plant of the two national projectile factories at Renfrew; these will form part of the increases in buildings and plant necessitated by the reduction of the ordinary working hours from 57 to 47.

Vickers-Metropolitan.—Allotment letters of the new issue created for the purpose of acquiring the shares of the Metropolitan Carriage, Wagon & Finance Co. were posted on Monday. In accordance with the agreement entered into between Vickers and the Metropolitan Co. for the purchase of the shares of the latter, the following directors of the Metropolitan Co. have been appointed directors of Vickers: Mr. S. Dudley Docker, C.B.; Sir E. V. Hiley, K.B.E., Mr. H. Walker, and Mr. E. Hickman. Sir George T. Buckham and Mr. H. J. Morriss have also been appointed directors of Vickers.

Chloride Electrical Storage Co., Ltd.—Final dividend of 5 per cent., tax free, on the ordinary shares, making 10 per cent. for the year.

Western Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of income tax, for the year ending June 30th, 1919, being at the rate of 6 per cent. per annum.

Chesham Electric Light & Power Co., Ltd.—Dividend 5 per cent.; to depreciation £800; carrying forward £3,139.

La Plata Electric Tramways, Ltd.—After paying debenture and other interest there is a loss for 1918 of £2,731.

STOCKS AND SHARES.

TUESDAY EVENING.

NOTICEABLE contraction in Stock Exchange market activity is one of the features since last we wrote. In House colloquialism, markets have rather boiled over. Big rises had occurred, and a few operators started to take profits in such shares as Marconis and others which had enjoyed dramatic advances. One seller makes many, and, as markets turned from a condition of buoyancy to one of greater caution, a steady stream of sellers appeared. Fresh hints of a Government Consolidation 4 per cent. Loan at 80, with earlier commencement of annual drawings at 100, tended to weaken prices of gilt-edged stocks offering lesser attraction. Investment and speculation have both shrunk considerably in volume.

Exceptional strength is that shown by the Undergrounds. A general tip to buy the £10 shares of the Underground Electric Railways led to the price being hoisted to 4, from which they went back to 3¾. The shilling shares rose to 11s. 3d. before a slight reaction set in, and the income bonds hardened to 95½. In sympathy with this movement, Districts recovered ½. Meanwhile the steam stocks dwindle in price day by day.

The decline in home electricity shares, started by the Second Reading of the Government Bill, has been arrested, but business is very quiet, and there is little doing in any of the leading shares. Manufacturing shares are steady. The Electric Construction report shows that the profits for the year just ended were £68,700, some £1,900 better than the previous year's figures. As already noticed here, the dividend and bonus, making 10 per cent., are repeated, and the reserve fund is raised to £85,000, with nearly £39,000 carried forward. English Electrics keep firm at 28s. 6d. Edison Swans eased off a shade. A new introduction to the market is C. A. Vandervell shares, the company which specialises in motor-car lighting, and dealings began in the £1 ordinary at 33s. 9d., in the shilling deferred at 6s. 6d. The former have reacted to 32s. 6d. Johnson & Phillips new ordinary shares were largely over-subscribed. There is no check at present upon the eagerness which the public display in taking up any new issue that offers reasonable security and prospects. Rumours continue to sport with the probability of forthcoming amalgamations in the electrical world.

British Electric Tractions drooped to 47½. Brazilian Tractions shed 2 points of their good rise. British Columbia Electric Railway issues have jumped up in consequence of the 2½ per cent. dividend declared on the preferred ordinary stock. This issue has risen 2 points to 46, and the deferred, which was down to 32 early in the present month, is now 43½. To the investor, the 5 per cent. preference stock standing at 62½ and paying 8 per cent. on the money, may be commended as useful to mix with others that yield less, for it deserves a capital appreciation of several points. Montreal Electric at 230 is 5 points higher. Gains of 1 are shown by Canadian General Electric at 125, and Consolidated Gas & Electric of Baltimore at 114, while Electric Light of Cochabamba bonds are 2 higher at 85½. On the other hand, Electrical Development of Ontario fives have weakened to 97½. The Mexican group has made further substantial recovery. Argentine Trams are rather harder.

Marconis, as already observed, proved somewhat reactionary. The price rose breathlessly to 6 9/16 on the hopes of what compensation from the Government next week may bring forth, but at this point the sellers came along in force, and the price subsided to 6¼, which still leaves, of course, a material improvement on the month. Marconi Marines touched 3 9/16 before easing off to 3 7/16, while American and Canadian Marconi reacted to 30s. 6d. and 16s. 9d. respectively. Direct United States Cable shares have made a good move towards recovering their recent heavy drop, and at 4¼ are 15s. higher. The s.s. *Faraday* was repairing the company's cable when it picked up Mr. Hawker's signal. The Eastern group is quiet. Holders are well satisfied to wait for what some of them regard as a certain increase in dividends, following upon that lately declared by the Globe Telegraph & Trust Co. Chile Telephones have fallen 7s. 6d.

Babcock & Wilcox had been dull, but rallied to 3¾ on the issue of the report. India-Rubber shares are over 5s. higher. Rubber shares as a whole are heavy, with a few bright exceptions. The new Vickers 5 per cent. tax-free preference are being dealt in about 20s. 6d. Copper shares show a disposition to improve.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES					
Brompton Ordinary	10	8	6½	—	£5 8 16
Charing Cross Ordinary	4	4	8½	—	6 3 1
do. do. 4½ Pref.	4½	4½	8½	—	6 18 4
Chelsea	5	5	8½	—⅛	4 2 9
City of London	8	8	11½	+⅛	6 14 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	—	6 18 8
do. do. 6 per cent. Pref.	6	6	10	+⅛	6 0 0
Kensington Ordinary	7	6	6½	—	5 4 4
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	6	6	8½	—	7 14 10
Metropolitan	4	5	8½	—	6 0 0
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 6
St. James' and Pall Mall	9	10	7½	—	7 0 4
South London	5	5	9½	—	7 5 6
South Metropolitan Pref.	7	7	9⅛	—	6 16 7
Westminster Ordinary	9	8	6½	—	6 10 8
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	88/6	22½	—	7 6 0
Chile Telephone	8	8	7	—⅛	5 14 4
Cuba Sub. Ord.	7	7	11	—⅛	*6 4 5
Eastern Extension	8	8	16⅜	—	*4 17 9
Eastern Tel. Ord.	8	8	166¼xd	+2	*4 16 1
Globe Tel. and T. Ord.	7	8	18½	—	*4 19 3
do. do. Pref.	6	6	15½	—	6 14 8
Great Northern Tel.	22	22	32	—	6 17 6
Indo-European	13	13	55	—	6 18 9
Marconi	20	20	6¼	—⅛	3 5 0
Oriental Telephone Ord.	10	15	23	—⅛	6 6 4
United R. Plate Tel.	8	8	7½	+⅛	*5 1 0
West India and Panama	1/3	1/8	1½	—	*4 8 4
Western Telegraph	8	8	17½	+½	*4 12 9
HOME RAILS.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1½	26½	—½	4 14 4
do. District	Nil	Nil	25	+½	Nil
Underground Electric Ordinary	Nil	Nil	3½	+½	Nil
do. do. "A"	Nil	Nil	10/8	+1/3	Nil
do. do. Income	4	5	95½	+½	*5 3 8
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	8½	+½	—
do. do. 2nd Pref.	—	—	2½	+½	—
do. do. 5 Deb.	5	5	68½	—	7 8 5
Brazil Tractions	—	—	62	—2	—
Bombay Electric Pref.	6	6	109	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62½	+2	8 1 4
do. do. Preferred	Nil	2½	46½	+2	5 7 6
do. do. Deferred	Nil	Nil	43½	+2	Nil
do. do. Deb.	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	62½	+2	Nil
do. 6 per cent. Bonds	Nil	Nil	53½	+5	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	70	+3	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3¾	—	3 17 6
British Aluminium Ord.	10	10	1½	—	5 18 6
British Insulated Ord.	25	12½	2½	—	5 11 1
British Westinghouse Pref.	7½	8	3½	—	5 19 6
Callenders	25	25	10½	—	6 3 0
do. 6½ Pref.	5	6½	3½	—	8 8 10
Castner-Kellner	25	20	9½	—½	6 5 0
Edison-Swan, "A"	—	—	1½	—	5 17 0
do. do. 5 per cent. Deb.	4	5	75½	—	6 12 8
Electric Construction	10	10	1½	—	7 16 0
Gen. Elec. Pref.	6	6½	10½	—	6 3 10
do. Ord.	10	10	21½	—½	*4 18 6
Henley	25	25	3½	—	5 5 3
do. 4½ Pref.	4½	4½	5½	—	5 16 2
India-Rubber	10	10	17½	+½	*6 14 3
Siemens Ord.	—	10	8½	—	*7 4 0
Telegraph Con	22	22	26½	—	4 19 6

*Dividends paid free of Income Tax.

THE TELEPHONE SERVICE OF LARGE CITIES, WITH SPECIAL REFERENCE TO LONDON.

By E. A. LAIDLAW, M.I.E.E., and W. H. GRINSTEAD, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The subscriber's estimate of the telephone service is the only real criterion of a satisfactory service. The subscriber, too, in including each factor in his estimate, unconsciously weights it according to the way it affects him. The authors do not wish to suggest that service observation is of little value, but it cannot do more than measure certain factors which are by no means all that the subscribers understand by "service."

Errors affect, even on the best operated equipments, 2 to 5 per cent. of the local calls, and up to 9 per cent. of the junction calls (Am). In addition, operating irregularities affect some 7 to 10 per cent. of the calls. Without changes in the type of equipment, an improvement in these figures might be obtained by lowering the operator's load. Possible modifications in equipment having for their object the assistance of the operator may effect some slight improvement, but their effect on the accuracy of the service must be slight.

Each of these errors and irregularities arises from an operator doing something which she ought not to have done. Modifications in equipment will not remove this human tendency to err; they can only lessen it. "Automatic" systems are not subject to errors of this nature. No considerable improvement in the accuracy of the service, therefore, can be expected from equipments of the manual type. For improvement we must look to the introduction of mechanical operation.

Concerning speed, the subscriber is influenced far more by extremes than by average figures. The extreme delays are in many cases due to operating errors. It is the period taken to receive a reply which is important from the subscriber's point of view, and is directly under control of the administration. An improvement is to be looked for in two respects, first a shortening of the average time taken to ring the wanted subscriber, and second, a greater uniformity in this time.

Improvement can only be obtained at considerable expense and by the sacrifice of the advantage of the increased load which alone would justify modifications to aid the operator. The introduction of mechanical apparatus for completing junction calls would bring the service on all calls up to the level of that shown for local calls. A further improvement would result from the extension of mechanical operation to the completion of both local and junction calls, *i.e.*, "full automatic" working.

The speed of disconnection is of particular interest to the busy subscribers. On about 10 per cent. of the calls, it is necessary for the subscriber to call in the operator by flashing the supervisory signal to make a further call. Although 5 seconds may appear to be a reasonably short time for the disconnection, it does not represent accurately the state of affairs as viewed by the subscriber. For instance, if the call has been one incoming from another exchange, the average time taken to disconnect and free the line becomes 10 seconds.

Extensive modifications of manual central battery equipments have been proposed to provide instantaneous disconnection. But it is doubtful whether it would be justifiable to incur the additional cost which would improve the service in this one particular only.

The elimination of delays in disconnection and in the establishment of further connections is an improvement which is afforded in a high degree by mechanical operation. The full benefit of this feature is not, however, obtained at present on some public automatic systems which are so arranged that the release of both lines is controlled by the calling subscriber.

The extent to which this arrangement detracts from the full advantage of instantaneous disconnection is, however, quite small.

The standards of construction to which modern administrations are working are such that no striking improvements in transmission are likely to be made. Future development is more likely to have its effect upon the methods of attaining these standards than in raising their level.

Two means are available of compensating for the transmission difficulties due to the use of small conductors and the length of the junctions. The application of loading in large cities is not easy. The increase of voltage, however, seems to present advantages in every way. In addition to improvements in transmission, the higher voltage affords larger margins on the operating requirements of the relays, and so reduces maintenance expense.

The cost of the increased amount of energy per call taken from the central battery, as well as any slight increase in the capital costs which can be ascribed solely to the increase in voltage, should be more than compensated for by the transmission and maintenance advantages.

It is possible that one voltage could be standardised for both manual and automatic equipments. The benefits would be considerable both to the administration and to the suppliers of exchange plant.

Operators' irregularities included all those which make a service unsatisfactory from the subscriber's point of view. One of the chief of these is the "number engaged" trouble. The percentage of calls on which the subscriber receives this report varies from 10 per cent. over the whole day on moderately busy exchanges up to nearly 20 per cent. during the busy hour on the busiest exchanges. Another item is the "no reply" report, which is given on about 2 per cent. of the calls. Some 2 per cent. of the incoming calls to a subscriber are cases in which he is called in error, and bad operating at private branch exchanges affect another 2 per cent. of the calls.

A reduction in the number of these irregularities is not altogether in the hands of the administration. An improvement is only to be sought in reducing the length of time each line is engaged, particularly during the busy periods. The holding time may be reduced by reducing the time taken to set up the connection, by improving the quickness of answer on the part of the called subscriber, and by reducing the time of disconnection. There is little hope of improvement in these items, without a change in the type of equipment. Automatic equipment promises a considerable reduction in the time of engagement. No difference is made in respect of the decrease in the duration of the conversation, amounting in some cases to as much as 40 per cent., which has been observed when an exchange is converted from manual to automatic working.

The irregularities due to subscribers and private-branch-exchange operators form a class for which, it may be claimed, the administration is not responsible. But this view cannot be entertained. It is the duty of the administration to modify its methods and equipment to reduce all sources of dissatisfaction to a minimum as far as this can be done economically.

No greater number of subscribers' irregularities is to be expected with the full automatic system than with the manual system, and the total amount of wrong number trouble, when that due to the operators is included, is likely to be considerably less. The increase of wrong number trouble with the amount of junction working is noticeable in the case of the manual exchanges. There will be no such increase with automatic systems in which the operation is precisely similar for both junction and local calls.

The authors have in the foregoing section tried to consider the matter from the point of view of the telephone-using public. Telephone service is a service rendered to and paid for by the public, and it is not those who render a service, but those who are served, whose opinion of the quality of the service must ultimately be accepted.

Without a departure from the types of equipment at present standard, there are two possibilities, namely, to improve the operators and to improve the equipments; neither alternative presents a hopeful prospect of effecting improvements in the service, especially when the large increase to be expected in the complexity and size of the telephone system is considered.

Turning to the possibilities afforded by newer methods of operation, experience shows that mechanical operation will afford a service of improved accuracy and speed, particularly in those items which appeal to the public. Assuming 80 per cent. junction working, the called subscribers' bell is rung in an average time of 10 sec., as against 26.2 sec. on a call with manual service. 98 per cent. of his connections are completed to this stage in 30 sec., against 68 sec., and he can free himself and establish a second connection with no delay whatever. The use of mechanical operation has also a favourable effect on the number of irregularities, particularly upon the "number engaged" trouble. Experience shows that the wrong numbers called by subscribers with the dial are 1.4 per cent., against 1.9 per cent. On systems in large cities the difference would be even more marked. Cut-offs and double connections occur less frequently, and the fear that the subscriber would prove incapable of handling the dial correctly has proved groundless.

There appears to be therefore little hope of effecting improvements in the quality of the service with the existing manual types of switching equipment. Mechanical operation, however, offers improvements in almost every item.

An ideal tariff, from the commercial standpoint, should be proportioned to the expenses in every respect. This cost is made up of (i) costs individual to the subscriber; (ii) costs of setting up the connection; and (iii) charges on the common connecting plant.

The old "flat" rate tariff ignored the fact that the service given to different subscribers might vary considerably in the cost of setting up and in the use made of the common connecting plant. The "message" and "measured rates" take account of this, and the third item is covered roughly by charging "junction fees."

The only equitable way of allocating the expenses of the common plant is in relation to the amount of it brought into use and the time of its use for each connection.

The problem is much simplified by the acceptance of the principle of a "unit of telephone service" as a basis for the variable part of the charge made to the subscriber. The meter which records the units consumed is assumed to be in

operation continuously during the conversation, and the rate at which the units are consumed on any given connection can be varied according to the amount of plant involved. A subscriber would be charged for his telephone service almost in the same way as for his electric light, varying according to the apparatus he brings into use.

This method of charging is scientific and fair, simpler than the message or measured rate, and will be readily understood by the public. It very considerably simplifies the problem of automatically registering special-fee calls on mechanically operated systems.

By making arrangements such that the rate of recording on all meters can easily be altered, differential rates for different times of the day can easily be arranged. This permits attention to be given to the telephone load factor. Any improvement in the load factor would have a considerable effect on the cost of providing exchange and junction equipment for large cities. Further,, the reduced rates for the greater part of the day would lead to a much increased use of telephone communication and would undoubtedly appeal strongly to the small user. The subscriber might be afforded the protection of a certification of the correctness of his meter and metering circuit by an independent authority. Its practical application of the principle of the "telephone unit" is not without its difficulties, but the investigations already made, although retarded by the war, have advanced sufficiently to demonstrate its practicability.

Under the present conditions any exact analysis of expenses is of little value. What can be examined with advantage, however, is the general direction in which each quantity concerned is varying, and the probable effect of this variation.

The authors have tried to consider what alterations in the methods and plant of the telephone service of large cities might be made to enable the changed conditions to be faced. They find that nearly every indication is in favour of the extensive application of mechanical operation. Although the prices of automatic equipment have been subject to the same rise as all other manufactured products, there are possibilities of considerable reductions, due to improved design and manufacturing methods, when the quantities to be handled become more reasonable from the manufacturer's point of view than they have been in the past.

The introduction of a full automatic system would very considerably reduce the administrative and operating charges which form about 23 per cent. of the expenses per station and show tendencies to increase out of all bounds in the future. Experience shows that it would effect very little, if any, increase in the maintenance costs, which form another 23 per cent. A reduction of rents and other building charges would result. The item "interest," amounting to 11 per cent., would show a slight increase, but it must be remembered that a large proportion of the interest refers to the line plant. Depreciation (24 per cent.) would tend to be increased, assuming the same life for automatic equipments as for manual.

To proceed in the future with automatic equipment will result in expenses lower than with manual equipment, and will afford relief from the upward tendencies of the several important items of expense. Certainly, if the change is to be made, there is likely to be no more favourable opportunity than the present.

The question arises: to what extent shall mechanical operation be applied, is the "semi-automatic" or the "full automatic" system to be preferred for telephone service in large cities?

The experience and records of the performance of the full automatic systems which have now been working in this country for some years, show that control by the operator is unnecessary, except in such special classes as trunk connections and those from coin boxes. Even the latter could be handled automatically if suitable methods of charging for the calls were adopted. The work of the operator is very considerably facilitated by the semi-automatic apparatus, but its monotony is even greater than with the manual system.

The additional capital cost of the subscribers' dials with the automatic system is almost balanced by that of the operators' equipment and impulse-sending devices with the semi-automatic system, while the latter must be debited with the greater floor space and greater administrative and operating charges. The speed of the service afforded by the full automatic system is undoubtedly greater than that on the semi-automatic. In cases where a direct comparison has been made to ascertain the subscriber's attitude to the question, the result has shown a decided preference for the "full automatic." The subscriber is evidently quite willing to undertake the dialling rather than await the attention of an operator, even with the speed with which the semi-automatic apparatus endows her.

There is in the semi-automatic system a feature which appears attractive for the transition period, namely, that the existing exchange names and numbers may be retained. Special keys are provided, one for each exchange, the depression of which causes the impulses directing the connection to that exchange to be sent. With an extensive area, the number of these keys becomes excessive. The present difficulties in accommodating and operating order-wire keys are sufficient to condemn any proposal of this nature. This difficulty could be avoided by adopting the automatic numbering scheme for the semi-automatic system, but this eliminates the very feature the attractiveness of which led to discussion of the question. Even if adopted for the early stages of the conversion with a view to avoiding number changes, the changes would have to be faced on the later conversion to full automatic, and they would then be a much more serious matter on account of the largely increased number of subscribers.

The case of London always springs to mind as the one in which the difficulties of conversion are more serious than in any other city in the world. The London telephone area extends over 640 square miles, and in spite of its extent it is one organic whole. The intercourse between each part of it and the remainder is such that any attempt to divide it into two or more distinct areas fails on account of the impossibility of choosing a boundary across which the amount of intercommunication could be satisfactorily handled by the methods usually employed between separate areas.

Allowing for increase in the population within the area, and assuming a development up to a figure of 10 for the inhabitants per telephone, the number of stations will ultimately not be far short of one million, with a corresponding number of direct lines of 700,000. The average number of lines per exchange at present is roughly 2,000. The size of a manual exchange is limited by the length of the operator's arm and minimum diameter practicable for the connecting plugs to about 10,000 working lines. On the manual system, therefore, some 150 to 200 exchanges would be ultimately necessary. Even with the number of exchanges existing, over 70, the difficulties of junction working are severely felt in their effect both on the service and on the expenses. It becomes, indeed, questionable whether a purely manual system would be capable of dealing satisfactorily with the ultimate conditions.

In densely developed areas it will be desirable to provide direct junctions between each automatic exchange and every other in order to secure the shortest routes for the large numbers of junctions. The junction arrangements are therefore the same as with the manual system, although operating costs are absent in the automatic system. Insurance against interruptions in service and convenience in the organisation for the maintenance of junction circuits would also tell in favour of direct junctions.

The position of an automatic exchange is determined by very much the same factors as those operating with the manual system, chiefly subscriber's line mileage, and land and building costs. In the suburbs, where the telephones are distributed in groups separated by comparatively open districts, the facilities afforded by the automatic system for opening sub-exchanges, without incurring additional costs for "B" operating, would lead to the provision of more exchanges and so would have an influence on their position. Where the denser parts form an area of elongated shape an exchange towards each end might take the place of a single exchange in the centre.

In densely developed Central London the size of the exchange, no longer limited by the length of the operator's arm, would tend to increase in order to secure the advantages of the reduced cost per line of large buildings. It would, under the ultimate conditions, be limited possibly only by the physical difficulties of providing duct space in the approaches to the exchange building. The exchanges in the suburban districts would therefore tend to be more numerous, and those in the central districts less numerous, than with a corresponding manual system.

The selection of the method and time for the change of the subscribers' numbers is one of the serious problems to be faced in the introduction of the full automatic system. Seeing how intimately it affects the subscribers, it calls for ample consideration and boldness and firmness in applying the solution decided upon. As a manual system develops the need for number changes is always present. With the full automatic system, however, if a well-designed numbering scheme based on careful development studies is applied at the outset, the numbers then allotted need suffer little change thereafter.

The authors' proposal would be to change at one time the numbers of all the subscribers connected to exchanges in the "Inner London" area, *i.e.*, within the boundaries of the present County of London. Each "Outer London" exchange would retain its present name and numbering until it became incorporated in the full automatic exchange system. This distinction between "Inner" and "Outer London" would not appear unreasonable to the subscribers, for the dividing line is already marked.

The proposal to change all "Inner London" exchange names and numbers to the new automatic region names and numbers at one time prior to the commencement of the work of converting the plant, has numerous advantages. The change could be made shortly after the public announcement of the decision to install the automatic system, at a time when the subscribers would be in a mood to accept it willingly. It could be made at a date which might be definitely fixed a considerable time in advance, so that the subscribers have plenty of notice. Further, there is the very considerable advantage in changing all the numbers at the same time that each user knows his correspondents' numbers are being changed. This should assist considerably in the reduction of inquiry traffic after the change. The earlier the change is made the less the inconvenience both to the subscribers and the administration. A wholesale change not only tends to reduce the actual trouble always attendant on number changes, but is likely to give rise to less irritation and imaginary trouble than a succession of piecemeal changes extending

over eight to ten years. By making a universal change before commencing the conversion, time is given for subscribers to become accustomed to the new numbers and one of the difficulties attending exchange transfers is eliminated.

Only the "Inner" (County of London) area would at first form a united automatic exchange system. Any outlying exchanges converted would remain individual centres, retaining their old name and, perhaps even to a large extent, their old numbering, just as Epsom, which has already been converted, does at present. As the network is built outwards to them, they could assume the new numbering and be embodied in the main system.

The authors think that the changes that have already taken place and are now in progress among the telephone-using public and in the labour and manufacturing worlds, are such as to demand considerable advances in types of plant and methods, if improvements in the service and provision against increased expenses are to be made in the future. Little more than the present standard of service is to be expected from manual switchboards, and mechanical operation offers striking improvements in service and a means of reducing those items of expense which show the strongest tendencies to increase.

As to the time of the introduction of the automatic system, the immediate future is undoubtedly the most favourable, offering an opportunity which will not occur again. On account of the war, not only are the amount of plant and the number of subscribers affected less than they will ever be in the future, but the depreciation account is in a better position to stand the heavy replacement charges than it would be in normal times.

An attempt has been made to show by a study of the London area that there are no fundamental difficulties to be expected in the application of automatic systems to large cities, either in the ultimate arrangements or during the transition period.

The authors do not wish it to be thought that they have attempted to say in any way how the case of London ought to be treated. They have merely used it as an example to draw attention to, and stimulate discussion of, the effects on the provision of telephone service of the recent serious changes in many factors.

Discussion.

Sir W. Slingo opened the discussion by congratulating the authors on the valuable addition they had made to the literature on this subject. The present paper was the second important one that had been read before the Institution on this subject. It was only as recently as 1912 that the first experiments with automatic exchanges were made in this country, and they already had something like 14 such exchanges at work. He had always anticipated that automatic exchanges would come during his lifetime, but he had certainly never expected to see them adopted during his working career. In his opinion, if the automatic system was to be introduced in any area, the whole of that area should be converted at once, and not one part at a time. If he remembered rightly, they had in the London telephone area something like 74 exchanges; the difficulty of converting such a number of exchanges would therefore be appreciated, and should not be minimised. Another difficulty he foresaw was that of manufacturing the necessary apparatus that would be required. In this country there were only three firms that could manufacture the requisite equipment on a sufficiently large scale, and if one out of the three firms secured the contract he did not see how it would be able to deliver in a reasonable space of time. On the other hand, he did not quite see how they would be able to surmount the difficulties that would arise if they had several contractors working on different parts of the equipment at the same time, as uniformity of equipment throughout London was essential. Referring to the Leeds automatic exchange, which had now been in service for 12 months, Sir William admitted that he had had grave misgivings about it at first, but it had, much to everyone's relief, given complete satisfaction. It was a question of tackling the thing in the right manner, and not commencing with too large a figure. Now that the Leeds five-figure exchange had proved itself satisfactory, he did not see any reason why a six-figure exchange should not work, nor even why the system should not be applied to London with equally good results. With regard to costs, the capital cost of automatic exchanges was about 60 per cent. greater than for manual exchanges, but the annual costs were less for the former type, and it became a question of satisfying the purse-holder. Another problem was that of the shortened life of the manual exchange when displaced in favour of the automatic, and in his opinion this cost should be debited to the automatic exchange. In conclusion, he congratulated the authors on having drawn such a large gathering to hear their paper read.

Col. C. B. Clay took exception to certain remarks made by the previous speaker; he (Col. Clay) had some 3,000 men at work that day, and he was prepared to double that number at any time. The statement that there were only three firms in this country that could manufacture the requisite equipment on a sufficiently large scale was, he thought, quite unfair. Turning to the paper itself, he had not had time to go into it, and was not, therefore, prepared to discuss the subject. He suggested that the Institution should allow more time for members to digest the papers before they came up for discussion.

Col. Sir A. M. Ogilvie, C.B., congratulated the authors on the field covered by the paper; he well knew the amount of work that must have been involved. With regard to costs, he thought the automatic exchange had made good, and similar remarks would apply to the question of increased efficiency. Experience had shown that the difficulties of the five-figure exchange were not so great as had commonly been thought. Concerning conversion from manual to the automatic system, he thought that gradual conversion would be found to be extremely difficult, and it would take something like 12 years to complete in an area like London, not forgetting the increased difficulty and cost of working the system during the period of transition. Nevertheless, in about 12 years' time he thought the existing system would have become quite incapable of dealing with the traffic, and the problems of conversion would, therefore, sooner or later have to be faced.

Mr. C. A. Baker's remarks were chiefly confined to tariffs. He would like to know whether the tendency was to increase rather than decrease tariffs. Of course, owing to the war, it was very difficult to say what the costs should be to-day, but in his opinion the £5 10s. or £6 10s. charged for the installation of a telephone in the London area was much too high. The Post Office argued that in the London area each subscriber had a much larger number than usual of people with whom he could talk, but it could also be argued that the Post Office had a much larger number of subscribers in that particular area than was usually the case. Another point that he had noticed was that the efficiency of services was much higher in small towns than in large ones. Concerning the checking of accounts, the Post Office kept its accounts hidden away, and no subscriber ever had a chance of checking same. Perhaps some form of meter system, where the meter was on the subscriber's premises, might reduce the amount of friction that occurred on this point at the present time. Another point of importance was that of security against breakdown. The Press had stated that during the recent snowstorms something like 11,000 lines were brought down. This was really a very bad state of affairs, and he (Mr. Baker) thought the Post Office might with advantage use a higher factor of safety.

Mr. J. E. Kingsbury said that the Post Office and the manufacturers had always succeeded in treating each other fairly in the past, and in his opinion the difficulty suggested by Sir W. Slingo would be found capable of satisfactory solution.

The rest of the speakers dealt mainly with questions of detail. The importance of the transition arrangements were emphasised, and it appeared that the present cost of automatic equipment was much higher than that of the manual type. This, it was considered, should be reduced, and the conversion of the London system would justify manufacturing methods having this object in view. The question of renumbering subscribers was discussed as one of the greatest importance to the public. Suggestions for avoiding or reducing it were made, but it appeared that code numbers or letters indicating the exchanges would have to be prefixed to subscribers' individual numbers. The average official "life" of a telephone operator was stated to be only four years, so that there would be no great displacement of operators by the change.

The authors reserved their reply for insertion in the *Journal* of the Institution.

THE STILL ENGINE: A NEW PRIME MOVER OF HIGH EFFICIENCY AND BRITISH ORIGIN.

By FRANK E. D. ACLAND, M.Inst.C.E.

(*Abstract of paper read before the* Royal Society of Arts, *May 26th*, 1919.)

The conversion of heat into useful work, with the minimum of waste, depends on the efficiency of the means employed; that is to say, it depends on the losses in the heat cycle, and on the losses in the mechanism employed for producing the heat and converting it into power.

"The efficiency of a heat engine is the ratio of the heat converted into mechanical work to the total amount of heat which enters the engine." It by no means follows that an engine, which thermodynamically attains the highest indicated efficiency in relation to the ideal, is in practice the most efficient for its purpose, or the most economical in fuel.

Efficiency from the user's point of view is the ratio of the useful work to the total heat in the fuel used.

Comparing the cycle of steam with that of combustion engines, the latter has two great advantages over the former. The fuel which imparts the heat to the working fluid is introduced directly into its working cylinder, and the temperatures and pressures are far above the limits of those possible in the steam engine and boiler.

The steam engine suffers from heavy heat losses in the creation of its heat; it is forced to work at comparatively low temperatures and pressures, and with superheating, compounding, and condensing added to it, has arrived at a point

where further efficiency is well-nigh impossible. The further recovery of thermal loss in the steam engine, or in the mechanism, is a difficult, if not an almost impossible, task. In the internal-combustion engine all the losses at present existing are capable of some recovery, and certainly of considerable reduction.

The maximum ideal efficiency of a heat engine is obtained where the difference existing between the highest and lowest temperatures of the working fluid is greatest in proportion to the maximum temperature, and here the internal-combustion engine, with an initial temperature higher than the furnace temperature of the boiler, and even higher than the melting-point of cast iron, is capable of realising better thermal conditions than any other form of heat engine; but in its turn it suffers from two disadvantages—it ejects its working fluid at a temperature too high for ideal conditions, and it loses heat energy to a regrettable extent in the cooling of its cylinder.

The result obtained in practice from the two cycles separately, based on their best performances after half a century of intensive development, is that in the steam engine there is a loss of over 80 per cent. of the heat contained in the fuel, and in the combustion engine of 60 per cent.

The recovery and efficient use of the waste has been the work of many years of patient research by William Joseph Still and others associated with him, and has resulted in the design and construction of a variety of engines which bear out the correctness of his principles, and point to a vast field of further practical application.

employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine, and reduces the consumption of the fuel per H.P. developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so ensure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder, and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per H.P. developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

In the Still engine (fig. 1) the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam; the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall

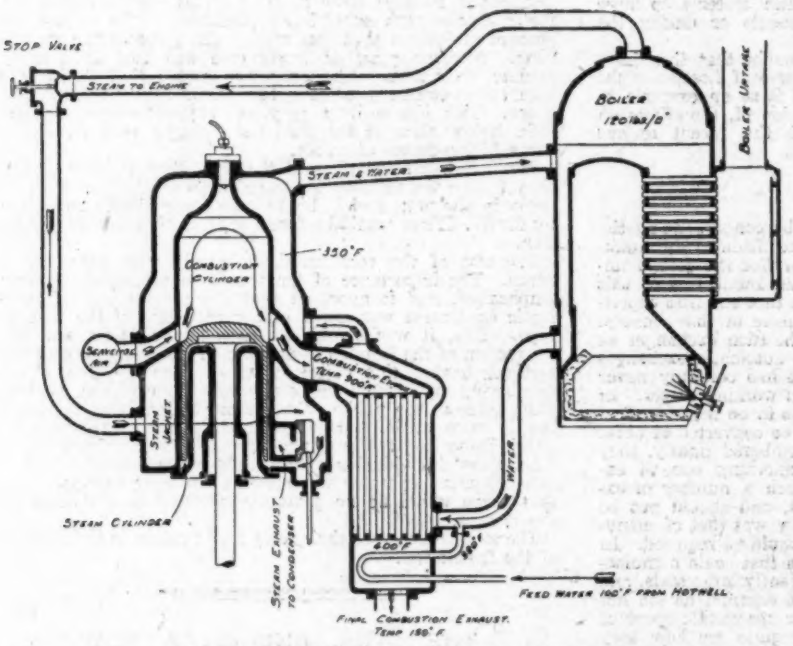


FIG. 1.—THE STILL ENGINE; SECTIONAL DIAGRAM.

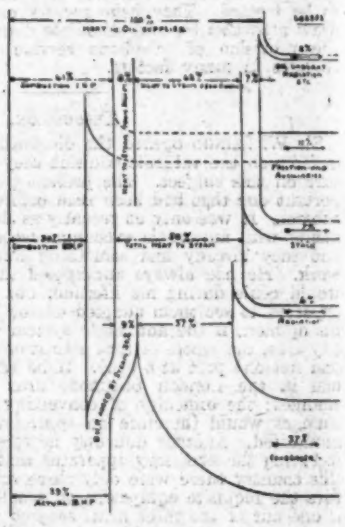


FIG. 2.—HEAT BALANCE DIAGRAM.

The possibility of combining in one engine the superior thermal cycle at the high temperatures and pressures of the combustion engine with the low thermal cycle of steam to deal with its rejected heat, and, in the same engine, add the superior working advantages of the steam engine, was the basis of his work.

The development of the internal-combustion engine has included many proposals and attempts to utilise the heat going to waste in the exhaust and cooling water; but while in existing engines some proportion of the heat can be usefully recovered as steam from the exhaust gases, the cooling water from the jacket is of little value, owing to its low temperature, and the efficiency of the engine itself is not augmented. If, however, the temperature of the cooling water could be maintained at that of steam at useful pressure, the efficiency of the engine would be improved and the weight of steam be usefully increased.

It has been inadvisable during the past four and a-half years to allow publication, but the time has arrived when the principles of this new development should be available for examination and discussion, and an account be given of some of the results achieved. The results already obtained from engines which are admittedly experimental types, constructed under disadvantageous conditions, are sufficiently remarkable to substantiate their claim to be of real importance, while they give promise of far wider application and further improvement.

The Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto

is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion, and expansion—is diminished.

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat, instead of losing it, during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full outstroke, and is compressed to a pressure where its increased temperature ensures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion, the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economised adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

To ensure the maintenance, in a practical and reliable manner, of the temperature conditions which produce this efficiency during the combustion cycle, a departure from the design and construction of the cylinders of normal internal-combustion engines is imperative; they have hitherto been made of cast iron, of a thickness sufficient to resist the working and thermal stresses thrown upon them, including occasional heavy loads caused by pre-ignition of the explosive charge. With these thick walls or liners, the temperature difference between their inner and outer surfaces, which is essential if the surplus heat is to be carried off, can only be obtained safely by the circulation of water at low temperature through the jacket; this is especially the case in cylinders of

considerable diameter, or capable of high power per swept volume.

The cylinder of a Still engine consists of an inner liner, which is approximately one-third to one-fourth of the usual thickness; it is ribbed externally so as to add to its conducting surface and provide suitable passage for the cooling water, and it is reinforced by an outer hoop capable of withstanding the highest pressures to be met with in working. The stresses due, in ordinary practice, to the cold water at the inlet, and the hotter water at the outlet, are suppressed in the Still cylinder, the cooling water being at a controlled and uniform temperature throughout (fig. 3).

No failure of a cylinder of any kind has occurred, even under most severe, even abnormal, test conditions, *e.g.*, with mean combustion pressures of 180 lb. per square inch in a two-stroke engine, to which was added overload steam mean pressures of 70 lb., *i.e.*, a total M.E.P. per revolution of 250 lb. per sq. in.

Steam from Waste Heat.

In gas and oil engines of constant-volume and constant-pressure types, the combined losses in radiation, cooling water, and exhaust gases, range between 75 per cent. and 65 per cent. The highest indicated thermal efficiency claimed under test conditions with a Diesel engine (Mathot) 300 B.H.P., four-stroke, at three-quarter load, is 47 per cent. (36 per cent. brake efficiency). If 4 per cent. is allowed for radiation, 49 per cent. of the total heat is available for recovery, and if 10 per cent. efficiency is assumed for the steam cycle, the brake thermal efficiency of an engine giving this high result would be raised by 10 per cent. of 49 = 4.9, *i.e.*, 36 + 4.9 = 41 per cent.; but there is no reason why the steam generated and used under the conditions of the Still system should be limited to so low a figure. Fifteen per cent. seems a more reasonable assumption, and even a higher figure may be anticipated, in which case a brake thermal efficiency of 44 per cent. should be possible in a complete installation.

The Still engine may be of the constant-volume or constant-pressure type, or a combination of both; its losses to the cooling water are not the same as in a normal engine of either type, except in so far that they vary with the type, with the cycle, with the efficiency of the combustion stroke, and with the load. At normal and full loads, such heat

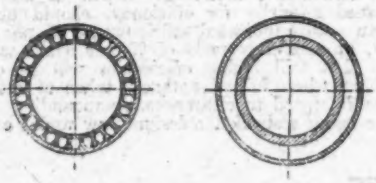


Fig. 3.—Sections of Cylinders of the Still Engine and Ordinary Gas Engine.

units, in a Still engine, as pass into the jacket water, which is at steam temperature and pressure, are lessened and are wholly recovered without loss—radiation excluded—in overcoming the latent heat of the water and give off their steam in the steam space in proportion to the heat flow at those loads. At lower loads less steam is produced, until at still lower loads no steam at all is measurable. In other words, the jacket losses are practically eliminated.

The exhaust gases take a subsidiary, but important part in the cycle; their usefulness in ordinary combustion engines, in raising steam, is limited to the amount of heat recoverable between the initial temperature of the exhaust and that of, say, 50 deg. F. above the steam temperature, after which the whole volume passes away to atmosphere at a still useful temperature, less a small percentage available for feed-water heating. But in the Still engine, the exhaust gases, after raising their quantum of steam, are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads, show terminal stack temperatures as low as 150 deg. F. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2,000 deg. F., and a final exhaust to atmosphere at 150 deg. F.

The weight of steam recovered may vary from a maximum of about 7 lb. per B.H.P.-hour, developed by the combustion cycle of a four-stroke constant-volume engine, at full load, to a minimum at light loads which is hardly measurable.

The steam thus recovered is a by-product, is limited in amount, and its value depends upon the efficiency of its employment. This is carried out in a logical manner. In place of being expanded in external auxiliary engines, with their thermal and mechanical losses, it is returned to the combustion cylinders of the Still engine, and is expanded on the opposite side of its main piston, one stroke being performed by steam and the other by combustion.

The piston and cylinder walls, pre-heated by the combustion stroke, are at a higher temperature than the steam when it is admitted and while it is being expanded; there is, therefore, no loss from condensation, and the steam exhausts at a slight superheat above the normal expansion temperature, a condition which is unattainable in any form of steam engine without direct loss of energy (fig. 4). With an early cut-off, it can be expanded economically right out to atmospheric pressure, or below it, and be either re-compressed (Stumpf cycle) or exhausted to condenser. The steam, during expansion, forms an efficient means of cooling the piston.

The effect of the steam in its co-operation with and reaction on the combustion cycle has been the subject of many series of exhaustive tests. The engine used for this research was of constant-volume type, four-stroke. It first underwent a series of tests, so as to arrive at its "initial H.P." as an explosion engine. The quantity of steam generated per "initial B.H.P." from the jacket alone averaged 3.28 lb. per B.H.P.-hour, and from the jacket and exhaust together 6 lb. per B.H.P.-hour. A whole series of these early trials was carried out under the supervision of Mr. C. Vernon Boys, F.R.S.

The *mean* temperature of the cylinder walls is higher than in ordinary engines; the piston is cooler, owing to the expansion of the steam behind it; the heat efficiency of the combustion cycle is augmented, owing to the walls being at a higher and constant temperature; frictional losses are reduced by the higher temperature, and by the steam overcoming the inertia of the reciprocating masses at the lower dead centre;* the mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of similar type; the steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine; 29 per cent. of additional B.H.P. is added to the shaft of the engine, without increase in the fuel consumption (steam not condensed); 40 per cent. is added with condenser used (air pump separately driven); the I.H.P. due to steam appears as B.H.P. added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion B.H.P. The average M.E.P. from the combustion stroke was 90 lb. per sq. in. The steam evaporated by the "waste heat" gave 14 lb. per sq. in. M.E.P. on every return stroke. This is equivalent to 90+28=118 lb. per sq. in. M.E.P. in a normal four-stroke engine.

By admitting additional steam generated by fuel under

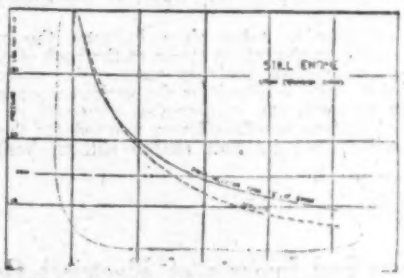


Fig. 4.—Steam Indicator Diagram.

the boiler, the steam M.E.P. was raised to 72 lb. per sq. in.; the total M.E.P. was, therefore, equal to 90 + 144 = 234 lb. per sq. in. M.E.P. in a normal four-stroke engine.

The first experimental gas engine constructed was a two-stroke engine capable of developing 590 B.H.P. from three cylinders at 400 R.P.M., bore 8 in. It was a high-speed engine, designed with special regard to obtaining data about the recovery of steam from waste heat (jacket and exhaust). It was first operated on town gas—540 B.TH.U., and subsequently converted for oil fuel. Its efficiency was not high, owing to its being a two-stroke engine with a short stroke, but its consumption per B.H.P. was 15 cu. ft. per hour (31.3 per cent. efficiency), a very promising result.

With a combustion indicated efficiency of 36 per cent., radiation 4 per cent., boiler loss 10 per cent., there remains 50 per cent. for recovery; allowing 10 per cent. efficiency for the steam cycle, a gain of 5 per cent. is assured, and the total indicated efficiency of the engine will not be less than 41 per cent. If 20 per cent. efficiency is obtained from the steam cycle, as appears possible, the total indicated efficiency will be 46 per cent.

A gas engine which can give a brake thermal efficiency 30 per cent better than its predecessors, and which, by governor control alone, can meet any demand up to and over 100 per cent. overload, while maintaining a good efficiency at that increased output, cannot be neglected.

Great improvements have lately been made in gas producers, some of light weight, which answer automatically to all variations of load. The addition of a steam cycle to gas engines operating with these producers, will give a means of manœuvring and starting which will fit them for service as marine engines and locomotives for road or rail.

The Still heavy oil engine starts with the cylinders and

* In Prof. Hopkinson's trials the frictional loss at 65 deg. F. was nearly double that when the jacket water was at the maximum obtainable, 212 deg. F. In Still's trials, the jacket water was at a constant temperature of 320 deg. F.

pistons pre-heated. The air charge, from the moment of its entry into the cylinder, picks up heat from the containing walls and continues to do so during at least 70 per cent. of the compression stroke, with the result that the temperature necessary for firing with certainty the first injected charge of fuel is reached with a compression pressure 50 per cent. less than that required in a Diesel engine.

A Still heavy-oil engine can be designed for constant pressure or constant volume, or both can be employed in the same engine by correct timing of the fuel injection. It claims for its combustion cycle an efficiency higher than that of the Diesel, less weight and space per H.P., and for its combined cycle an efficiency not less than 20 per cent. higher than any prime mover which uses fuel as its source of heat.

The first engine designed for the use of heavy oil was of the opposed-piston type, 16 in. diameter, 32 in. total stroke, 150 R.P.M., the combustion taking place between the pistons with the steam generated by the jacket water and exhaust gases expanded at the back of both pistons (the steam passed from the auxiliary boiler through H.P. and I.P. cylinders and finally to the Still engine as an L.P. cylinder, and thence to the condenser).

The steam H.P. and I.P. cylinder was connected to a prolongation of the main shaft at 90 deg. to the main crank; all auxiliaries were separately driven, thermo-couples were connected to all important points in the plant between the combustion space and base of stack. The oil was injected by blast air, scavenge by a fan, pressures from .5 to 1 lb. per sq. in. It was fitted with a brake and fly-wheel of 4¼ tons weight; from full power (300 B.H.P. at 160 revolutions) it will reverse by a single lever from ahead to astern in ten to twelve seconds.

The fact that these engines are capable of running under steam alone, and under constant temperature conditions, gives a facility and security in carrying out preliminary tests and subsequent accurate research which is not possessed by any other combustion engine. All mechanical adjustments, valve setting, degree of compression, temperatures, and so on, can be established at all speeds before any fuel is injected into the main cylinder.

The dimensions of the cylinder were: Bore, 13¼ in.; stroke, 22 in.; two-stroke cycle, opposed pistons; steam side as for L.P. cylinder. It forms the basis of a six-cylinder set, two of them using H.P. steam, which is compounded into the other four as L.P.

The combustion takes place between the pistons, the steam acting on the return stroke at the back of both pistons. After a series of preliminary tests under steam alone, in which data were obtained for the various mechanical adjustments, the scavenge, compression pressures, and temperatures, at various speeds, oil was injected for the first time. The engine fired its first charge without hesitation, and completed a series of tests of over two hours' continuous running, without adjustment, giving an output by gradually increasing the weight of oil admitted of 100, 150, 200, &c., up to 400 I.H.P., at a maximum speed of 380 R.P.M., for which she was designed.

This unit has been subjected to many long and varied tests by representatives of various Governments, as well as to constant research work under severe conditions. Its best consumption of fuel (Admiralty shale oil) has been as low as 0.302 lb. per B.H.P. (scavenge pump not included), over a test of one hour's duration under normal waste-heat conditions. It developed 330 B.H.P. for six hours at 360 R.P.M. (a single cylinder) under waste-heat conditions. It will develop 400 B.H.P. continuously with added steam, and has developed 540 B.H.P. at 380 revolutions over short periods. (Combustion M.E.P. 128.2 lb., steam M.E.P. 57.9 lb., total M.E.P. 186.6 lb.) The thermal brake efficiency from below quarter-load to full power is maintained at approximately 40 per cent. over the whole range.

With added steam from the boiler, 5,000 B.H.P. would be obtained from two six-cylinder sets, with a weight of about 70 tons, including all auxiliaries and water, and extreme overloads up to 6,000 B.H.P. could be obtained.

The application of the Still system to commercial marine work is being developed in this country and abroad; the two-stroke single-piston type, in powers of 100 H.P. per cylinder and 400 H.P. per cylinder, having been adopted.

Engines of this type at 120 R.P.M., with a cylinder 22 in. diameter by 36 in. stroke, giving 4,200 S.H.P. on two shafts, with all auxiliaries and water, would weigh about 600 tons. A geared-turbine plant in a similar ship would weigh 20 per cent. more, and would consume approximately 2,000 tons more fuel for a double journey lasting 1,000 hours.

The success already achieved has led to a careful study into the application of this system to locomotive work.

A Still engine designed for locomotive work would be capable of giving an efficiency at the rails of 30 per cent. over 90 per cent. of its running time—six times as good as the present locomotive; while during the accelerating period its efficiency would be at least 15 per cent., or three times as good. In surmounting long inclines with heavy loads, the engine would be capable of developing about four times the power which it develops at its most efficient or normal running load.

That a two-stroke, high-speed engine of an early type, not designed specially for efficiency, should already have reached an actual indicated efficiency of 47 per cent., that is to say, an efficiency ratio of 70 per cent., warrants the assurance that still higher efficiencies will be obtained in later designs, where full advantage is taken of lessons already learned with regard to clearances, compounding, and so on, which are being embodied in designs now under construction.

Exports and Imports of Electrical Goods during January, February, March, and April, 1919.

THE official returns of electrical imports and exports for the months of January, February, March, and April, 1919, which we publish below, show as regards exports, an increase of £535,734 over the four preceding months, and an increase of £705,172 over the first four months of 1918. The figures are as follows:—

1918.		1918.		1919.	
Jan. ...	£225,585	Sept. ...	£280,438	Jan. ...	£390,210
Feb. ...	255,064	Oct. ...	263,501	Feb. ...	326,658
Mar. ...	174,482	Nov. ...	229,091	Mar. ...	420,452
April ...	255,771	Dec. ...	307,370	April ...	478,754
	£910,902		£1,080,340		£1,616,074

All the items, except carbons, show increases in values as compared with the last four months, the principal improvements occurring in electrical goods amounting to £189.000; insulated wire, £144,000; batteries, £124,000; and electrical machinery, £48,000.

The electrical imports for the first four months of the year were:—January, £97,292; February, £178,384; March, £163,269; April, £196,634; as compared with September, £124,233; October, £143,902; November, £124,077; December, £85,416; an increase of £157,000 for the four months, and an increase of £37,000 over the first four months of 1918. The figures for telegraphic and telephonic imports for the four months of 1919 under review, show an increase of £72,000, while considerable increases appear in the items for electrical goods and machinery. The re-exports of foreign and overseas electrical material show a slight increase, the totals being—January, £5,115; February, £11,255; March, £8,108; April, £6,095; as compared with September, £6,330; October, £6,196; November, £10,092; December, £1,332.

Total number of electric glow lamps exported, imported and re-exported, for the past four months:—

	Exports. No.		Imports. No.		Re-exports. No.
Jan.	114,375	Jan. ...	524,130	Jan. ...	1,700
Feb.	113,063	Feb. ...	419,685	Feb. ...	48
March	125,307	March ...	277,844	March...	3,209
April	99,432	April ...	589,254	April ...	2,800
Total for four months, 1919 ...	452,177		1,810,913		7,757

as compared with the totals for the first four months of 1918—exports, 600,159; imports, 421,668; re-exports, 213,266.

	January.			February.			March.			April.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exp'ts.
Electrical goods ...	87,440	16,106	2,856	69,950	79,755	2,722	85,295	36,162	2,916	80,037	33,033	2,889
Insulated wire ...	38,750	626	280	48,225	3,580	5,174	68,416	2,850	656	83,988	3,796	1,413
Glow lamps ...	9,146	22,367	52	7,997	20,766	19	8,965	35,421	338	7,937	56,004	150
Arc do. & parts ...	5,355	10,914	—	2,109	6,939	—	1,707	3,901	—	3,930	3,927	12
Batteries	53,067	6,689	99	31,330	2,479	—	53,165	3,876	50	29,343	1,195	16
Meters	17,618	2,611	297	10,498	3,363	—	6,949	4,438	60	25,193	2,497	50
Machinery ...	106,646	21,277	1,456	90,642	41,525	2,265	97,317	43,476	3,028	115,958	64,312	1,437
Carbons	189	2,946	—	487	1,649	452	—	2,474	—	1,784	1,205	8
Teleg. & telep. mat'l	71,999	13,756	75	65,240	18,328	623	98,638	30,671	1,060	130,584	30,665	120
Totals ...	£390,210	£97,292	£5,115	£326,658	£178,384	£11,255	£420,452	£163,269	£8,108	£478,754	£196,634	£6,095

DEVELOPMENT OF THE RIVER DEE.

A report by Mr. S. E. Britton, city electrical engineer, Chester, upon the practicability of developing the water power of the river Dee (North Wales) for the generation of electricity for agricultural purposes and rural industries was submitted to the Board of Agriculture and Fisheries last month, and is now under consideration.

Investigations of the river Dee for the utilisation of water power at the Chester weir commenced in 1911, and for the purpose of this report in August, 1917. The report is dated April, 1919. The Dee from Bala lake to Chester weir has a total length of 76 miles, and there are five principal named tributaries. The area of the catchment draining at Chester weir is 675 sq. miles, and the upper hilly parts of the basin consist generally of non-permeable strata; the rain water runs quickly off the sloping ground into the water courses feeding the main river. The rainfall in the basin varies considerably in different localities; the average yearly rainfall being 44 in. A rough estimate of the population of the area within the influence of the scheme would be rather less than 60,000 inhabitants.

The gradient of the river falls between Bala lake and Chester weir 534 feet. On the portion of the river under consideration, namely, Llangollen to Chester, the fall is 220 feet. Of this, 178 ft. is on 15 miles of river between Llangollen and Erbistock, and from Erbistock to Chester 42 ft. on 32 miles. Records indicate that the gradient and cross section of the river from Llangollen to Erbistock are such as will accommodate the maximum flow after heavy rainfall, and with the exception of a few small areas inundation does not occur to an important extent above Erbistock. From Erbistock to Chester the conditions are less favourable, and inundation is liable to occur for short periods over comparatively large areas.

There is abundant evidence that the neglected state of the river causes it in times of flood to rise to a higher level. The discharge of the Dee would be substantially improved by the removal of obstacles. The succession of bends between Bangor and Farndon have great influence on the discharge and inundation. From an engineering point of view it does not appear difficult to devise works to increase the discharge in this particular locality. A model representing 19 miles of river was experimented with and indicated that straightening would cut off ten miles of river, and shorten it 7¼ miles through the district liable to flood. The effect of straightening would increase the gradient from 0.8 to 1.6 ft. per mile, the discharge capacity approximately 85 per cent., and reduce the period of flooding by about 50 per cent. over approximately 3,000 acres of agricultural land. The cost of straightening, including controlling works at Chester, is estimated at £250,000. Whether the river is or is not straightened, a considerable benefit would be gained by providing additional means to let out flood water at the Chester weir. The Chester Corporation has under consideration a further development of the water power of the Chester weir, and this would be a favourable opportunity of carrying out a scheme for the twofold purpose.

As soon as the demand during periods of low river flow exceeds the water power available, then impounding should be taken in hand. It appears probable that the level of lake Bala could be raised 4 or 5 ft. without material detriment to the surroundings. The area of lake Bala is 1.9 sq. miles. Every foot which the present level can be raised would provide storage for 53 million cu. ft. of water. The Birkenhead Corporation water supply reservoirs will have an area of 1.22 sq. miles, and each foot that the level can be raised would give 34 million cu. ft. additional storage. The fall between Llangollen and Erbistock does not offer natural facilities for the development of both navigation and power. The fall between Erbistock, or Bangor-on-Dee and Chester, however, offers a more favourable proposition for navigation.

The strata and natural formation of the bed and banks of the Dee, and the contour of adjacent lands, offer suitable sites, free from engineering difficulties, upon which to construct weirs and power houses, with every prospect of carrying out the work at moderate cost and in a reasonable time.

From Llangollen to Erbistock the stations could economically utilise the run-off water for 275 days per annum; and from Erbistock to Chester 235 days per annum; in the former case there would be 90 days and in the latter 130 days per annum when the run-off water would exceed that which could be used. It appears that the water power of the Dee between Chester and Llangollen can be most economically harnessed by the erection of 16 weirs and hydroelectric installations. The heights of the weirs would vary from 7.5 to 37 ft., with an average height of 12 ft. The approximate power available per year at each station would vary from 1,808,750 to 11,823,660 units, an average of 3,737,356, or a total of 59,797,810 units, based on a continuous use of the power for 24 hours each day, the utilisation of the flow of the river for eight months per annum, and a portion of the flow for the remaining four months. The average aggregate monthly demand which the scheme would meet would vary from 1,937 to 10,625 KW.-hours, or an average of 6,805 KW.-hours based on the use of turbines of the same size at all stations except one, that being where the highest fall of 37 ft. is suggested. It is proposed that 15 of the stations be equipped with turbines capable of passing 30,000 cu. ft. of water per minute when operating at ¾ gate opening on a fall of 7 ft. This would make it possible for the whole of the apparatus to be made in this country, reduce spare parts to a minimum, and result in placing on the market a British-made turbine of type and size suitable for the development of low-fall water power on other suitable rivers.

For agricultural purposes 50 million units per annum would serve the requirements of about 800 sq. miles, equivalent to a belt of land 15 miles wide on each side of the river from Llangollen to Chester. Other interests near the river deserving of a supply would probably render the scheme of greatest national service by restricting it to a strip of land on each side of the river 3 to 5 miles in width, representing about 200 sq. miles. The smaller area would avoid the use of lengthy transmission lines and step-up transformers.

There is little doubt that the method of development under consideration could be extended up to Bala, and to a lesser extent along the principal tributaries of the Dee. Every source of water power in country districts capable of developing 10 H.P. and upwards, should have its commercial value carefully investigated. The financial success would depend on procuring a ready market for the disposal of the energy available, and its ultimate full use and maximum success upon the rapidity with which new industries are inaugurated. In promoting an undertaking of this character it is essential to organise an energetic business-getting campaign. Agriculturists and country folk shy at modern innovations and lack initiative. To break down this want of confidence the undertaking should be prepared to electrically equip several good examples of each of the different industries in the area of supply, on the principle of "no economy no pay." Such inducements would undoubtedly be of substantial benefit to all concerned.

The main transmission line, capable of transmitting 1,000 KW., would cost £800 per mile, that is £48,800, and transmission lines from the power stations to the main arteries, 27 miles, at £600 per mile, would cost £16,200, or a total of £65,000. The average cost of the installations would be £29,700. The cost of cutting a tunnel or tunnels capable of conveying 50,000 cu. ft. of water per min. to installation No. 12 is estimated at £60,000, making a total cost of the 16 installations and main transmission lines £600,200.

It is doubtful whether the whole of the scheme could be carried out at once. To start the scheme, stations at Bangor-on-Dee, Newbridge, and Llangollen appear to be the most suitable. These stations and 24 miles of transmission lines would serve an area of 96 miles. The three stations would generate 10,796,000 B.O.T. units per annum. The capital cost of three stations would be £106,920; and 24 miles of transmission line, £23,040, or a total of £129,960. The total annual expenditure would be £21,223, or 0.47d. per unit. After reducing the units generated by 20 per cent., there would be available for consumers 8,636,800 units, which, at an average income of 1.5d. per unit, would bring in £53,960, and leave a credit balance of £32,757 per annum.

The powers required to enable the scheme to be carried out and observations by Mr. A. C. Williams, engineer to the Dee Conservancy, are dealt with in appendices.

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

We have received the following communications from Mr. W. Arthur Jones, general secretary of the Association:—

Electricity (Supply) Bill.

The proposals of the Government in respect of the Electricity (Supply) Industry as laid down in the Bill recently introduced are of vital importance to the technical engineers engaged in that industry.

As the protective association of staff engineers engaged in the electricity (power and supply) industry, the Electrical Power Engineers' Association, in conjunction with other associations, has taken an active interest in matters pertaining to this Bill, and the National Executive Council of the E.P.E.A. appreciates that its proposals on this matter have received the sympathetic consideration of the promoters of the Bill. The suggestions of the E.P.E.A. were of necessity put forward without complete knowledge of the main proposals of the Bill, and now that these are available, some amendments are desirable to meet the case of the technical engineers.

Clause 5.—In clause 5, provision is made for representation on the District Electricity Boards. It is desirable that a definition of "labour" should be laid down, and attention is drawn to the Trades Disputes Act, 1906 (Sec. 5), and the Munitions of War Act, 1906 (Sec. 12), wherein "workmen" are defined on the widest basis of employés including staff. In the Electricity (Supply) Bill a similar definition should be added to clause 41, or clause 5 should be amended on these lines.

Clause 17.—In clause 17 provision is made for "compensation for deprivation of employment" *after* District Electricity Boards have taken over undertakings, but no provision is made for the compensation of any officer or servant who suffers deprivation of employment before the District Electricity Board has taken over undertakings, although under clause 20 two or more of the authorised undertakers may

combine their management, with probable reduction of staffs.

The following letter has already been received by a member of the E.P.E.A., dated May 13th, 1919:—

The situation created by the Government proposals for electricity supply has led to a reconsideration of the Power Company's plans, and a decision to do away with the construction department. In the circumstances your engagement with the company will be terminated at the end of June.

Further, the expression, "any generating station or main transmission line . . . any officer or servant who has been regularly employed in or about such station or line" does not cover all officers or servants of the distribution department of an undertaking, unless the expression "in or about" such station covers the whole undertaking to be taken over.

Clause 36.—In this clause, sec. 4, of the Conspiracy and Protection of Property Act, 1875, has been incorporated. If the right to strike is to be taken away from one section of the community, it is imperative that satisfactory means of adjusting differences and disputes should be provided for.

Attention is also drawn to the fact that staff officials do not come within the scope of the Wages (Temporary Regulation) Act, as such officials are not "workmen of a class to which a prescribed rate of wages is applicable," so that decisions of an agreed arbitrator are not legally binding, and can be, and have been, ignored by employers.

It is strongly urged that while it is necessary in the public interest to retain the clause in question, adequate arrangements should be made for the prompt discussions of any disputes or differences that may occur, and for the decisions arrived at to be made binding upon all parties.

Superannuation.—Clause 17 has a reference to the question of superannuation, but it is to be regretted that the opportunity to deal with this question on a national basis has not been utilised. Many staff officials, technical and otherwise, in the electricity (supply) industry are already participants in superannuation schemes, either national or local.

The E.P.E.A. is of opinion that this matter, and also the suggestions relating to compensation, could be met with the adoption in the Electricity (Supply) Bill of such clauses of sec. 60 of the Port of London Act, 1908, as are germane to the subjects.

Yorkshire Dispute Settled.

At a meeting held at Dewsbury on the 17th inst., the engineering staff of the Yorkshire Electric Power Co. resolved to hand in their notices as a protest against the curt dismissal of one of their number, a prominent official of the E.P.E.A., and on account of other grievances, including the unsatisfactory payments made under the E.P.E.A. Award 9,281, and called upon the National Executive Council of the E.P.E.A. to take immediate action.

A satisfactory reply not having been received from the company in the stipulated time, 74 members thereupon handed in their notices to terminate their engagements.

As a result of negotiations, a meeting was held on the 25th inst. between representatives of the board of directors of the Yorkshire Electric Power Co., together with the engineer and manager, when the matters in dispute were discussed. The principal point at issue was settled, and satisfactory assurances were given that the other grievances would be attended to without delay. Consequent upon the agreement, all notices terminating engagements are to be withdrawn and cancelled by both sides.

The head office of this Association has now been transferred to 65-66, Chancery Lane, London, W.C. 2. (Telephone Holborn 4806.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 885, High Holborn, London, W.C. 1.

11,873. "Thermionic detectors of electric oscillations." J. A. Fleming. May 12th.
11,888. "Electric battery cells." A. Spencer. May 12th.
11,909. "Electric switches." A. H. F. Peel. May 12th.
11,912. "Alternating-current motors, &c." E. S. Carey & Carey-Gavey Syndicate. May 12th.
11,916. "Means for controlling series of electric motors." F. G. Warburton. May 12th.
11,919. "Electromagnetic relays for control of electrical installations, &c." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 26th, 1918.)
11,920. "Electric contact devices." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 27th, 1918.)
11,921. "Electromagnetic controlling devices." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 28th, 1918.)
11,935. "Manufacture of incandescence electric lamps." F. Harrison. May 13th.
11,940. "Double combination magneto earthing switch." R. G. Metcalfe. May 13th.
11,953. "Assembling electric switches and accessories." J. B. Tucker and J. H. Tucker & Co. May 13th.
11,960. "Double combination magneto earthing switch." J. Britton. May 13th.
11,967. "Dynamo-electric machines." H. Knowles. May 13th.
11,978. "Electric liquid heaters." J. K. Greenhill, H. B. C. Pollard and G. P. Watson. May 13th.
12,003. "Sparking plugs." Soc. Generale des Huiles et Fournitures Industrielles d'Oleo. May 13th. (France, February 3rd.)
12,004. "Receiving systems for wireless telegraphy and telephony." H. J. Round. May 13th.
12,005. "Thermionic receiving devices for wireless telegraphy and telephony." H. J. Round. May 13th.
12,006. "Apparatus for wireless telegraphy and telephony." H. J. Round. May 13th.
12,007. "Telephone receivers." H. J. Round. May 13th.
12,008. "Receiving aerials for wireless telegraphy and telephony." H. J. Round. May 13th.
12,009. "Electric storage batteries." G. Marconi. May 13th.
12,015. "Method of fixing terminal screws or studs in carbon rods, bars, &c." I. Cornelis. May 13th.
12,033. "Cutting and shaping vulcanite, &c." C. Harrison & Sterling Telephone & Electric Co. May 13th.
12,042. "Obtaining single-phase alternating currents from existing three-phase systems." A. M. Taylor. May 14th.
12,045. "Sparking plugs." J. H. Banks & V. Crabb. May 14th.
12,080. "Electric horns." C. H. Offord & W. E. Parker. May 14th.
12,081. "Battery system for sparking plugs and electrical advertisement signs." E. L. Terrey. May 14th.
12,095. "Electric heater." J. Nolan. May 14th.
12,153. "Means for coating electric conductors, wires, springs, &c., with liquids." F. C. Cook. May 14th.
12,157. "Dynamo-electric machines." British Westinghouse Electric and Manufacturing Co. May 14th. (U.S.A., June 17th, 1918.)
12,158. "Protective apparatus for dynamo-electric machines." British Westinghouse Electric & Manufacturing Co. May 14th. (U.S.A., June 29th, 1918.)
12,165. "Electric switches." G. W. Biles & C. Sharp. May 14th.
12,166. "Ignition systems used with internal-combustion engines." E. Harrison. May 14th.
12,172. "Electrical receiving apparatus." F. G. Creed, Creed & Co., and D. McLennan. May 14th.
12,173. "Electrical receiving apparatus." Creed & Co. & D. McLennan. May 14th.
12,189. "Electric generators." C. H. Offord & W. E. Parker. May 15th.
12,192. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. May 15th.
12,195. "Ceiling roses, &c., of electric lamps, and means for controlling the latter." H. E. Hadwen & H. Willas. May 15th.
12,229. "Contractor devices for electric circuits." G. B. Mann. May 15th.
12,233. "Tool for electric cable." E. A. Claremont & G. H. Scholes. May 15th.
12,254. "Electrical precipitation of particles from gas." F. H. Haviland and D. K. Morris. May 15th.
12,269. "Negative elements for electric batteries." A. Pouchain. May 15th.
12,286. "Petrol-electric rail coach or truck for use as fire engines." H. H. Carter & Tilling-Stevens, Ltd. May 15th.
12,319. "Electrical measuring instruments." A. W. Lishman. May 16th.
12,325. "Protective covering of electric wires and cables." E. S. Seymour. May 16th.
12,337. "Electric switches." J. R. Craig. May 16th.
12,361. "Electric cookers." G. Wilkinson. May 16th.
12,373. "System of wireless direction finding." N. F. Hinton. May 16th.
12,412. "Ignition appliances for internal-combustion engines." T. H. Martyn. May 16th.
12,429. "Electric heating apparatus." M. Samanon. May 17th.
12,430. "Sponge appliances for administration of electricity." E. Peckham. May 17th.
12,436. "Method of securing sparking plug binding screws, &c." H. F. Smith. May 17th.
12,447. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. P. Lundberg & G. Pegg. May 17th.
12,466. "Electric hoisting motors, &c." W. E. M. Ayres & British Westinghouse Electric & Manufacturing Co. May 17th.
12,481. "Electric controllers." R. Amberton. May 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

12,566. Electrolytic oxidation process, and apparatus therefor. C. I. Syndicate, H. C. Jenkins, W. Blackmore & A. Howard. September 5th, 1916. (125,608.)
14,005. Means for detecting sounds. D. McLennan. October 3rd, 1916. (125,644.)
14,006. Diaphragms for use in or with sound-transmitting and sound-receiving instruments or apparatus. D. McLennan. October 3rd, 1916. (125,645.)
14,163. Means for interrupting electric circuits containing vapour converters. British Westinghouse Electric & Manufacturing Co. October 7th, 1915. (125,646.)

1917.

10,583. Dynamo-electric machines. Vickers, Ltd., & S. F. Barclay. July 23rd, 1917. (125,673.)

1918.

4,795. Electric motor generators. T. Preece. March 19th, 1918. (125,602.)
5,245. Electrical heating devices, especially adapted for use with hatching, bacteriological, and the like apparatus. Sir C. S. Forbes. March 23th, 1918. (125,703.)
6,453. Electrically-heating machine for stamping metal articles. J. Bill. April 16th, 1918. (125,719.)
6,659. Electromagnetic switches. British Thomson-Houston Co., & H. C. Hastings. April 19th, 1918. (125,732.)
6,682. Electrically-operated drilling apparatus. H. Scholey & F. K. Woodroffe. April 19th, 1918. (125,733.)
6,706. Protective devices for alternating current electric systems. A. E. McColl. April 20th, 1918. (Addition to 16,708/17. Cognate application 16,203/18.) (125,736.)
6,762. Electromagnetic switches. British Thomson-Houston Co. & H. C. Hastings. April 22nd, 1918. (125,740.)
6,781. Electrical switchgear. A. Reyrolle & Co. & H. W. Clothier. April 22nd, 1918. (125,741.)
6,932. Terminals for magneto-electric machines and other electrical apparatus. R. B. North & A. M. Allen. April 24th, 1918. (125,752.)
6,988. Electric lamp fixtures. S. W. Farber. April 25th, 1918. (125,760.)
7,006. Electric ignition devices for internal-combustion engines. W. O. Kennington. April 25th, 1918. (125,762.)
7,022. Apparatus for the electromagnetic treatment of the human body. J. Krauer. April 26th, 1918. (125,763.)
7,046. Electrical timing devices. J. Gray (Warren Clock Co., U.S.A.). April 26th, 1918. (125,766.)
7,969. Stabilised magnetic compass. G. B. Harrison & G. R. C. Campbell. May 13th, 1918. (125,791.)
7,978. Trolleys or collectors for electric tramways and the like. E. R. Thomas. May 13th, 1918. (125,792.)
8,220. Electro-therapeutic apparatus. H. Netter. May 16th, 1917. (116,281.)